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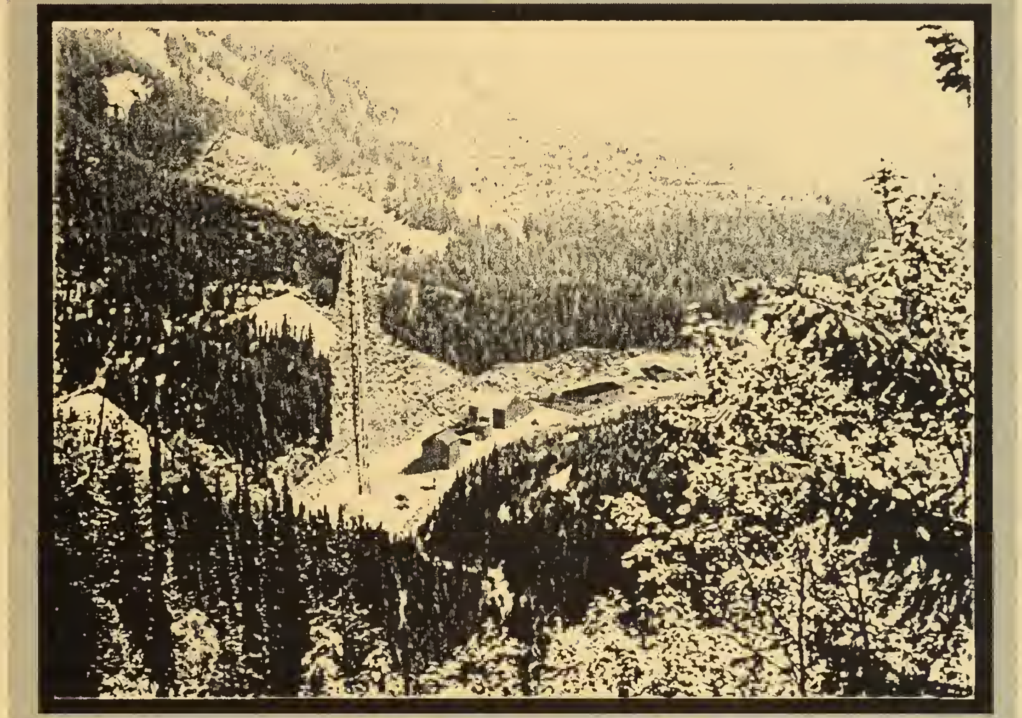
impact statement
ASARCO Rock Creek

Draft Environmental Impact Statement
ASARCO ROCK CREEK PROJECT



Prepared By:

Montana Department of Environmental Quality
and
U.S. Forest Service

July 1995

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The following errata items include supplemental and corrected information pertaining to Aquatics/Fisheries and Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species to include with the printed draft EIS for the ASARCO Rock Creek Project. The agencies will incorporate these items into the final EIS unless new information becomes available prior to completing the final document that changes the analyses.

Page 2-117, under Issue 1, 1st bullet and under Issue 2, 4th bullet:

> *Replace the phrase*: "(alternatives II and III)" with "(all action alternatives)" *in both bullets.*

Page 2-117, under Issue 2, 4th bullet:

> *Replace the phrases* "increased sediment" *with:* "reduced habitat quality" *and* "winter breeding" *with* "interbreeding."

Page 2-117, under Issue 2, 3rd bullet:

> *Insert the phrase:* ", increased mortality risks, and population reduction" *before the phrase* "(all action alternatives)."

Page 2-118, under Issue 3, first bullet:

> *Replace the entire bullet with:* "surface water quality and aquatic life in lower Rock Creek, Clark Fork River, Cabinet Gorge Reservoir, and Lake Pend Oreille if failure occurred (all action alternatives)."

Page 2-118, under Issue 5:

> *Replace entire bullet with:* "eliminate or reduce effectiveness of 91 to 208 acres of old growth (depending on the alternative) further reducing the percentage of old growth below biological levels recommended for long-term maintenance of old growth-associated species (all action alternatives)."

Page 2-119, Table 2-13 (Water Resources under Alternative II, 2nd paragraph):

> *Replace with the following paragraph:*
>
> **"Suspended sediment and nitrogen loads would be temporarily increased in Rock Creek and the West Fork during mine construction and nitrogen could impact aquatic invertebrates and algae in the short term."**

Page 2-119, Table 2-13 (Water Resources under Alternative II, 3rd paragraph):

Replace the entire paragraph with the following paragraph:

"Sedimentation associated with proposed timber harvest would be reduced because timber road construction on NFS lands in the Rock Creek drainage may be limited due to project increased open road densities. Sedimentation associated with the proposed project would increase over baseline conditions."

Page 2-119, Table 2-13 (Water Resources under Alternative II, 4th paragraph):

Replace the paragraph with the following paragraph:

"Impacts from materials from spills and pipeline ruptures potentially could affect water quality and aquatic life in Rock Creek and the Clark Fork River, including Cabinet Gorge Reservoir."

Page 2-122, Table 2-13 (Sensitive aquatic species under Alternative I, 2nd paragraph):

Replace the entire paragraph with the following paragraph:

"Aquatic resources would change over time due to natural cycles. Timber sale activities could impact aquatic resources. Bull and westslope cutthroat trout may continue to have a high risk of extinction."

Page 2-122, Table 2-13 (Sensitive aquatic species under Alternative III, 2nd paragraph):

Replace the entire paragraph with the following paragraph:

"Reduction of existing sediment sources in Rock Creek and Bull River drainages would reduce impacts to bull trout and cutthroat trout populations in Rock Creek and bull trout in Cabinet Gorge Reservoir, respectively."

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Page 2-122, Table 2-13 (Sensitive aquatic species under Alternative IV, 1st paragraph):

Replace the paragraph with the following bolded paragraph:

"Sediment impacts to bull and westslope cutthroat trout would be minimized in the West Fork of Rock Creek. The 300 ft. buffer around the confluence mill site would reduce sedimentation impacts downstream, although impacts to aquatic species may still be significant."

Page 2-122, Table 2-13 (Sensitive aquatic species under Alternative IV, 2nd paragraph):

Replace the paragraph with the following bolded paragraph:

"Similar to Alternative III but 300-ft. buffer around the confluence mill site would further reduce suspended sediment and associated impacts to bull and cutthroat trout in mainstem Rock Creek and bull trout in Cabinet Gorge Reservoir."

Page 2-125, Table 2-13, (Old Growth Ecosystems under title):

Delete the phrase: "(does not include replacement growth)."

Page 2-125, Table 2-13 (Old Growth Ecosystems under Alternative I, 2nd paragraph):

Delete the word: "viable."

Page 2-129, 4th full paragraph, first sentence:

Replace the phrase: "concentrations of sediment" *with the phrase:* "concentrations of suspended sediment"; *and replace the phrase:* "alternatives II and III" *with the phrase:* "all action alternatives."

Page 2-132, 3rd full paragraph, 2nd sentence:

Insert the word: "significant" *before the word:* "declines."

Page 2-133, 2nd full paragraph, 1st sentence:

Replace the word: "nesting" *with:* "roosting."

Page 2-134, 3rd full paragraph, last sentence:

Replace the sentence with the following sentence: "Planned road closures would reduce, but not eliminate, impacts due to human use and associated disturbances."

Page 2-136, 5th full paragraph:

Add this sentence after the 4th sentence ending "...Alternative IV).": "These are major impacts to maintaining the required amount of old growth habitat in Compartment 711."

Page 4-1, 6th bullet:

Insert the following sentence before the last sentence: "All impacts are considered to occur or last for both the long and short term unless otherwise specified."

Page 4-4, Table 4-2:

Replace the table with the following corrected table:

TABLE 4-2.
Changes to Old Growth (MA 13) by Alternative

	I[1]	II	III	IV
Old Growth Acres old growth lost	0	64	54	34
Acres old growth remaining	977	913	923	943
% reduction from current old growth	N/A	6.6	5.5	3.5
% old growth in Compartment 711	7	6.5	6.6	6.7
Replacement Old Growth[2] Acres lost	0	6	3	0
Acres of remaining replacement old growth	537	531	534	537
% reduction from current old growth	0	1.1	0.6	0
% replacement in Compartment 711	3.8	3.8	3.8	3.8
TOTAL ACRES LOST	0	70	57	34
% MA 13 (TOTAL)	10.8	10.3	10.4	10.5

Source: Kootenai National Forest 1995.

[1] This column contains existing acreages and percentages of old growth.

[2] Replacement old growth contains some but not all old growth characteristics and is part of MA13 as managed by KNF.

Note: There are 13,923 acres in Compartment 711 below elevation 5,500 feet. N/A means not applicable.

Page 4-65, 2nd full paragraph:

Replace the paragraph with the following paragraph: "Under Alternative II, ASARCO and the Agencies would identify up to 130 acres of land in the Bull River and Rock Creek drainages that exhibit high potential for or currently have soil erosion, slumping, and mass failure. This acreage would be identified by a field survey completed by ASARCO and the Agencies. Areas identified through this survey would also likely contribute the highest sediment loading to the Bull River and Rock Creek. After these areas have been identified, ASARCO would take action to repair these areas prior to construction of the mine. Reduction

of erosion in these areas would have the effect of mitigating project-related sediment loading to Rock Creek and reducing existing sediment loading in the Bull River. The resulting net increases in sediment loading and subsequent impact on total suspended sediment cannot be quantified, and would vary depending on weather and streamflow conditions."

Page 4-74, 2nd full paragraph, last sentence:

Replace the sentence with the following sentences: "Sediment mitigations in Rock Creek under alternatives III and IV could reduce project-related impacts to resident Rock Creek bull trout and westslope cutthroat trout and to Cabinet Gorge Reservoir bull trout. Sediment mitigations in the Bull River drainage under alternatives III and IV could reduce existing sediment-related impacts to Cabinet Gorge Reservoir bull trout."

Page 4-81, 3rd full paragraph, 1st sentence:

Replace the sentence with the following sentence: "Construction phase BMP audits, followed by corrective measures, would help reduce new sediment impacts."

Page 4-81, 3rd full paragraph, last sentence:

Replace the phrase: 'on Cabinet Gorge bull trout." *with* "on resident and migratory bull and westslope cutthroat trout."

Page 4-82, last paragraph:

Add the following sentences to the end of the paragraph: "Impacts to bull and westslope cutthroat trout in Rock Creek would be further reduced under this alternative by establishing a 300-foot buffer zone around the confluence mill site. However, despite mitigation measures, impacts to these species are likely to remain significant under Alternative IV."

Page 4-83, 3rd full paragraph, 1st sentence:

Insert the word: "adverse" *between the words:* "potential effects."

Page 4-83, 4th full paragraph:

Delete the first two sentences.

Page 4-84, 5th full paragraph, 4th sentence:

Replace the phrase: "(replacement growth[1])" *with the phrase:* "(such as replacement old growth[1])."

Page 4-84, last paragraph, 4th sentence:

Replace the word: "increased" *with the phrase:* "and other direct and indirect impacts occur."

Page 4-84, footnote:

Insert the phrase: "(see Forest Plan Direction)" *at the end of the sentence.*

Page 4-85, Table 4-25, 1st column, 2nd line:

Insert the word: "EFFECTIVE" *before the phrase:* OLD GROWTH (OG)."

Page 4-87, 1st full paragraph, 2nd sentence:

Replace the phrase: "less ineffective" *with the phrase:* "less effective or ineffective."

Page 4-87, last paragraph, 8th (last) sentence:

Replace the phrase: "Loss of degradation" *with the phrase:* "Loss and degradation."

Page 4-89, 2nd and 3rd full paragraphs:

Delete both paragraphs and insert the following paragraph after the 4th full paragraph which ends with: "...at this time.": "Between release of the draft EIS and the final EIS, proposed and ongoing data gathering efforts would provide additional information. For example, a more detailed delineation of habitat for the mid-sized carnivores (lynx, fisher, and wolverine) would be conducted using satellite imagery. Currently, a harlequin duck conservation strategy, being written under the lead of Idaho Department of Fish and Game, would provide additional insight to harlequin duck status and management."

Page 4-89, 4th full paragraph:

In the 1st sentence insert the word: "adversely" *before the phrase:* "affected by"; and in the 4th sentence insert the word: "adverse" *between the words:* "long-term effects."

Page 4-90, 3rd full paragraph, 1st sentence:

Delete the word: "some."

Page 4-90, last paragraph, 2nd sentence:

Replace the phrase: "Loss and" *with the phrase:* "Loss or."

Page 4-91, 2nd full paragraph, 1st sentence:

Replace the sentence with the following sentence: The proposed project would increase mortality potential if direct or incidental trapping increased as a result of mine-related human population growth (see Recreation)."

Page 4-91, 3rd full paragraph, 2nd sentence:

Insert the phrase: "portions of" *before the phrase:* "Rock Creek drainage."

Page 4-91, 5th full paragraph:

Replace the entire paragraph with the following paragraph: "The proposed project would eliminate and degrade critical fisher habitat (such as old growth), and increase human disturbance and mortality risks. This would result in much of Rock Creek drainage becoming a less or an unsuitable place for fishers to live. The effects of the proposed project on fisher populations and recovery in the Cabinet Mountains is discussed in context of cumulative effects at the end of this Biodiversity section."

Page 4-91, last paragraph:

Insert the phrase: "Trapping risks and" *at the beginning of the 3rd sentence; and in the 4th sentence replace the phrase:* "be low." *with the phrase:* "not be high."

Page 4-92, 2nd full paragraph, 2nd sentence:

Insert the phrase: "Trapping risks and" *at the beginning of the sentence and delete the phrase:* "and incidental trapping."

Page 4-100, 4th full paragraph:

Add the following sentence to the end of the paragraph: "Effects would be similar to those that would occur under Alternative II."

Page 4-101, 1st full paragraph, 1st sentence:

Insert the word: "adverse" *between the words:* "most effects."

The following conclusionary statements for the Chapter 4 sections on Aquatics/Fisheries and Biodiversity of Wildlife Habitat/Vegetation and Wildlife Species have been provided to assist the reader.

Page 4-2, 1st bullet:

> *Insert the following sentences before the sentence beginning* ***"Significant":*** "At some points in the text, the terms major, moderate, minor and negligible are used. Their purpose is to indicate ***magnitude*** of effects. These terms do not convey significance."

Page 4-74, 4th full paragraph:

> *Add the following sentence to the end of the paragraph under Alternative I:* "Impacts to aquatics/fisheries resources in other water bodies would be minor."

Page 4-78, 2nd full paragraph, both sentences:

> *Insert the phrase:* "moderate and" *before the word:* "significant" *in both sentences. Insert the phrase:* "and minor in the long term" *at the end of the last sentence.*

Page 4-78, 4th full paragraph, last sentence:

> *Insert the phrase:* "could be negligible to moderate in the short term and" *after the phrase:* "Alternative II."

Page 4-78, 7th full paragraph, last sentence:

> *Insert the word:* "major and" *before the word:* "potentially" *and insert the phrase:* "and minor in the long term" *at the end of the sentence.*

Page 4-78, last paragraph, last sentence:

> *Insert the following phrase at the end of the sentence:* "and negligible in the long term."

Page 4-79, 1st full paragraph:

> *Insert the following sentence at the end of the paragraph:* "Habitat impacts to Rock Creek under Alternative II would be moderate in the short term and negligible in the long term."

Page 4-79, 6th full paragraph:

> *Insert the following sentence at the end of the paragraph:* "Impacts to aquatic invertebrates would be minor to major in the short term, and minor to moderate in the long term."

Page 4-80, 3rd full paragraph (single sentence):

> *Insert the phrase:* "major and" *before the word:* "significant."

Page 4-80, 6th full paragraph, 2nd sentence:

Insert the phrase: "minor and" *before the phrase:* "potentially significant."

Page 4-81, 1st partial paragraph, 1st line:

Insert the phrase: "major and" *before the phrase:* "significant in the Short term" *and insert the phrase:* "minor to major and" *before the phrase:* "potentially significant."

Page 4-81, 4th full paragraph, last sentence:

Replace the phrase: "potentially significant" *with the phrase:* "minor but significant."

Page 4-81 5th full paragraph:

Insert the following sentence to the end of the paragraph: "Impacts to water temperature under Alternative III would be negligible."

Page 4-81, 6th full paragraph:

Insert the following sentence to the end of the paragraph: "Impacts to stream habitat would be moderate in the short term and negligible in the long term under Alternative III."

Page 4-82, 1st full paragraph:

Insert following sentence to the end of the paragraph: "Therefore, impacts to aquatic invertebrates are expected to be minor to moderate in the short term and negligible to moderate in the long term."

Page 4-82, 2nd full paragraph, last sentence:

Insert the phrase: "major and" *before the phrase:* "significant."

Page 4-82, 3rd full paragraph:

Insert the following sentence to the end of the paragraph: "Therefore, impacts to the West Fork of Rock Creek from spills would be negligible under Alternative IV."

Page 4-82, 6th full paragraph:

Insert the following sentence to the end of the paragraph: "Therefore, impacts to stream habitat under Alternative IV would be negligible."

Page 4-82, last paragraph:

Insert the following sentences to the end of the paragraph: "Impacts to fish in the West Fork Rock Creek under Alternative IV would be minor in the short term and negligible in the long term. Impacts to fish in mainstem Rock Creek would be minor to major and significant."

Page 4-83, 1st full paragraph, 3rd sentence:

Insert the phrase: "minor to major and" *before the phrase:* "potentially significant."

Page 4-83, 2nd full paragraph, last sentence:

Insert the word: "major," *before the phrase:* "long-term effects".

Page 4-83, 4th full paragraph:

Insert the following phrase at the beginning of the 3rd sentence: "Major and"; *insert the following word at the beginning of the 5th sentence:* "Major."

Page 4-86, 1st partial paragraph, 5th line:

Insert the following sentence: "Impacts to plant species of special concern under Alternative II would be major in the short term." *before the sentence beginning:* "A conservation assessment ..."

Page 4-86, 1st full paragraph:

Insert the following sentence at the end of the paragraph on Noxious Weeds: "Impacts from the spread of noxious weeds under Alternative II would be moderate in the short term and minor in the long term."

Page 4-87, 4th full paragraph:

Insert the following sentences before the last sentence: "For some vegetative communities, such as old growth, impacts would be major. For other wildlife habitat/vegetative communities, impacts would be minor to major."

Page 4-88, first full paragraph (single sentence):

Insert the phrase: "major and" *before the word:* "significant."

Page 4-89, first full paragraph (single sentence):

Insert the phrase: "would range from minor to major and" *before the phrase:* "could be significant."

Page 4-90, 4th full paragraph (single sentence):

Insert the phrase: "major and" *before the word:* "significant."

Page 4-91, 6th full paragraph (single sentence); Page 4-92, 1st full paragraph, last sentence; and Page 4-92, 4th paragraph, (single sentence):

Insert the phrase: "major and" *before the phrase:* "potentially significant."

Page 4-92, 5th full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to the Townsend's big-eared bat under Alternative II would be minor in the short term and negligible in the long term."

Page 4-92, 6th full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to the bog lemming under Alternative II would be negligible."

Page 4-92, last paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to the black-backed woodpecker under Alternative II would be minor."

Page 4-93, 1st full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to the Coeur d'Alene salamander under Alternative II would be negligible."

Page 4-95, 2nd full paragraph:

Insert the following single sentence paragraph after the 2nd full paragraph: "Impacts to mountain goats under Alternative II could be moderate to major in the short term and moderate in the long term."

Page 4-95, 6th full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to elk under Alternative II would be minor to moderate in the short term and minor in the long term."

Page 4-95, 7th full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to white-tailed deer under Alternative II would be moderate in the short term and negligible in the long term."

Page 4-96, 1st full paragraph (single sentence):

Insert the phrase: "major and" *before the phrase:* "potentially significant."

Page 4-96, 5th full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to black bears under Alternative II would be moderate in the short term and minor to negligible in the long term."

Page 4-96, 6th full paragraph:

> *Insert the following sentence at the end of the paragraph:* "Impacts to mule deer under Alternative II would be minor in the short term and negligible in the long term."

Page 4-96, 8th full paragraph:

> *Insert the following sentence at the end of the paragraph:* "Impacts to mountain lions under Alternative II would be minor in the short term and negligible in the long term."

Page 4-97, 3rd full paragraph:

> *Insert the following paragraph after the 3rd paragraph:* "Impacts to birds under Alternative II would be minor and likely would not affect overall populations except for old growth-associated species and harlequins ducks."

Page 4-98, 2nd full paragraph:

> *Insert the following paragraph after the 2nd paragraph:* "Impacts to plant species of special concern under Alternative III would be major in the short term unless known populations could be avoided, in which case they would be negligible to minor in the short and long terms. If avoidance were not possible more information would be needed to determine long-term impacts."

Page 4-98, 3rd full paragraph:

> *Insert the following sentence at the end of the paragraph:* "Impacts from noxious weeds under Alternative III would be minor to moderate in the short term and minor in the long term."

Page 4-99, 1st partial paragraph:

> *Insert the following sentence at the end of the paragraph:* "Impacts to wildlife habitat/vegetative communities (excluding old growth habitat) under Alternative III would be minor to major."

Page 4-99, 1st full paragraph, last sentence:

> *Insert the phrase:* "major and" *before the word:* "significant."

Page 4-99, 4th full paragraph (single sentence):

> *Insert the phrase:* "minor to major and" *before the phrase:* " potentially significant."

Page 4-99, 6th full paragraph, last sentence:

> *Insert the phrase:* "potentially major" *before the phrase:* "impacts on goats."

Page 4-99, 7th full paragraph:

Insert the phrase: "major and" *before the phrase:* " potentially significant."

Page 4-100, 1st full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to plant species of special concern under Alternative IV would be major in the short term unless known populations could be avoided. If avoidance were not possible, more information would be needed to determine long-term impacts."

Page 4-100, 2nd full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts from the spread of noxious weeds under Alternative IV would be minor."

Page 4-100, 3rd full paragraph:

Insert the following sentence at the end of the paragraph: "Impacts to wildlife habitat/vegetative communities under Alternative IV would be minor to major."

Page 4-100, 5th full paragraph (single sentence):

Insert the phrase: "major and" *before the word:* "significant."

Page 4-100, 6th full paragraph (bullet):

Insert the following sentence at the end of the paragraph: "Impacts to mountain goats under Alternative IV would be major in the short term and moderate to major in the long term."

Page 4-101, last paragraph, last sentence:

Insert the phrase: "minor to major and" *before the phrase:* " potentially significant."

Draft
Environmental Impact Statement

ASARCO, INCORPORATED'S ROCK CREEK PROJECT

July 1995

U. S. Forest Service
Kootenai National Forest

Robert L. Schrenk, Forest Supervisor

Montana Department of
Environmental Quality

Mark Simonich

Mark Simonich, Director

COVER SHEET

Type of Statement: Draft Environmental Impact Statement

Proposed Action: Construction and operation of ASARCO, Incorporated's (ASARCO) Rock Creek Project

Lead Agencies:
Kootenai National Forest
Montana Department of State Lands (after July 1, 1995, part of Department of Environmental Quality)

Cooperating Agencies:
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
Idaho Department of Health and Welfare

Abstract:

ASARCO's Rock Creek Project Draft Environmental Impact Statement describes the land, people, and resources potentially affected by the proposed Rock Creek copper/silver mine. The major federal and state action consists of the approval of all necessary permits to construct and operate the Rock Creek Project. The proposed project would consist of seven primary components: an underground mine, a mill, four adits and portals, a tailings impoundment, access roads, a 6.9-mile utility corridor, and a rail load-out. Four alternatives are analyzed in detail in this draft EIS: a no-action alternative, ASARCO Incorporated's proposed action, the proposed action with mitigations, and a modified project with mitigations.

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PREFACE

An EIS is not usually read like a book, from chapter one to the end. The best way to go about reading an EIS depends on where your interests lie. You may be more interested in impacts, while others might have more interest in the details of the proposed plan, or be more concerned about what opportunities were made available for the public to be involved in the environmental assessment process. Many readers probably just want to know what is being proposed and how it will effect them.

This document follows the format established in the National Environmental Policy Act and the Montana Environmental Policy Act regulations (40 CFR Parts 1500-1508 and ARM 26.2.601-663, respectively). The following paragraphs outline information contained in the chapters and appendices so that readers may find the parts of interest without having to read the entire document.

- **Summary:** contains a short, simple discussion to provide the reader and the decision makers with a sketch of the more important aspects of the EIS. The reader can obtain additional, more detailed information from the actual text of the EIS. The summary for the Proposed Rock Creek Project EIS is a separate, stand-alone document which is paired with the draft EIS.

The chapters through Chapter 4 are found in Volume 1 of the draft EIS for the Rock Creek Project; Chapters 5 through 9 and the Appendices are found in Volume 2. The chapters are briefly described below:

- **List of Abbreviations and Acronyms:** This list describes the abbreviations and acronyms used throughout the EIS.

- **Chapter 1 - Purpose and Need for the Action:** describes the proposed action, purpose and need for the action and the EIS, project area, agency roles and responsibilities, decisions to be made, and public participation.

- **Chapter 2 - Description of Alternatives:** describes the significant issues associated with the proposed action and the development of alternatives. It identifies the pertinent components of the proposed action and alternatives, including the no-action alternative. Other alternatives that were considered but dismissed are identified along with rationale for not including them in the analysis. Reasonably foreseeable activities in the vicinity of the proposed project are identified. This chapter also provides a comparative analysis of the environmental impacts of the primary alternatives to provide a clear basis of choice among options for the decision maker and the public. The lead agencies' preferred alternative is identified.

- **Chapter 3 - Affected Environment:** describes the present condition of the environment that would be affected by the proposed action and alternatives.

- **Chapter 4 - Environmental Consequences:** describes the probable impacts to the human environment that would result from developing the proposed action or alternatives, including cumulative impacts, short-term uses versus long-term productivity, unavoidable impacts, and irreversible or irretrievable impacts.

- **Chapter 5 - Consultation With Others:** lists the agencies, companies, and organizations consulted as well as the cooperating agencies.

- **Chapter 6 - Preparers and Contributors:** lists the people involved in the research, writing, and internal review of the draft EIS.

- **Chapter 7 - Distribution and Review of the EIS:** lists agencies, organizations and individuals who received a copy of the draft EIS.

- **Chapter 8 - Glossary:** describes the technical terms used in the draft EIS.

- **Chapter 9 - References Cited:** lists the references cited in the draft EIS.

- **Index:** contains cross-references and identifies the pages where key topics can be found.

- **Appendices:** contain key supporting documents for the draft EIS. The draft EIS for the Rock Creek Project has nine appendices.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAA	American Automobile Association
ABA	acid base accounting
ACHP	Advisory Council on Historic Preservation
ADT	average daily traffic
AIRFA	American Indian Religious Freedom Act
AP/NP	acid potential/neutralization potential
ARM	Administrative Rules of Montana
ASARCO	ASARCO, Incorporated
BA	Biological Assessment
BAA	bear analysis area
BLM	Bureau of Land Management
BMP	best management practices
BMU	bear management unit
BPA	Bonneville Power Administration
CEM	cumulative effects model
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMW	Cabinet Mountains Wilderness
COE	U.S. Army Corps of Engineers
const	construct/construction
cu	cubic
cy	cubic yard
dBA	decibels, A scale
DFWP	Montana Department of Fish, Wildlife and Parks
DHES	Montana Department of Health and Environmental Sciences
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
EIS	environmental impact statement
elev	elevation
EPA	U.S. Environmental Protection Agency
et seq.	and the following
FDR	forest development road
ft./day	feet per day
gpm	gallons per minute
GVW	gross vehicle weight
HD	hunting district
HRT	hydraulic residence time
hwy	highway
ID	Idaho
IDNHP	Idaho Natural Heritage Program
IDT	interdisciplinary team
ISC	Industrial Source Complex
KNF	Kootenai National Forest
kV	kilovolt
kW	kilowatt
kWH	kilowatt hours

LAD	land application disposal
MA	management area (in Forest Plan)
MAC Report	Mineral Activity Coordination Report
MCA	Montana Codes Annotated
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
mg/L	milligrams per liter
mi	mile
MPDES	Montana Pollution Discharge Elimination System
MPH	miles per hour
MRL	Montana Rail Link
MSHA	Mining Safety and Health Administration
MT	Montana
MTNHP	Montana Natural Heritage Program
NAGPRA	Native American Graves Protection Act of 1990
NEPA	National Environmental Policy Act
NFS lands	National Forest System lands
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
ORD	open road density
PCTC	Plum Creek Timber Company Limited Partnership
PMF	probable maximum flood
ppm	parts per million
PSD	prevention of significant deterioration
psi	pounds per square inch
PVC	polyvinyl chloride
$Q_{7,10}$	7-day, 10-year low flow
QA/QC	quality assurance/quality control
RD	ranger district
ROD	record of decision
ROS	Recreational Opportunity Spectrum
SHPO	State Historic Preservation Office
TDS	total dissolved solids
TMDL	total maximum daily load
TSL	traffic service level
TSP	total suspended particulates
TSS	total suspended solids
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMS	Visual Management System
VQO	visual quality objective
WQD	Montana Water Quality Division
WWP	Washington Water Power

CHAPTER 1

THE PURPOSE, NEED, AND PERMITTING PROCESS FOR THE ROCK CREEK PROJECT

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CHAPTER 1: THE PURPOSE, NEED, AND PERMITTING PROCESS FOR THE ROCK CREEK PROJECT

INTRODUCTION

This draft Environmental Impact Statement (EIS) for the Rock Creek Project documents the analysis of possible environmental consequences of a proposed action and alternatives to the action. ASARCO's proposed action -- the construction and operation of the Rock Creek Project -- and three alternatives have been analyzed in this EIS. The purpose and need for the proposed action; the EIS process; the agencies' roles, responsibilities, and decisions; and public participation for the Rock Creek Project are described in this chapter.

PURPOSE AND NEED FOR THE PROPOSED ACTION

ASARCO proposes to construct, operate, and reclaim all facilities necessary to mine, remove, and transport economically minable minerals from the Rock Creek deposit. The 1872 General Mining Law, as amended, allows U.S. citizens the right to locate, explore, and develop mining claims on federal lands, such as national forests, that are open to mineral entry; or, if closed to mineral entry, subject to valid existing rights. Additionally, the Alaska National Interest Lands Conservation Act guarantees access to private inholdings (this is interpreted to include valid rights under the mining laws) "...to secure the owner the reasonable use and enjoyment thereof..." ASARCO perfected its rights to the Rock Creek deposit within the Cabinet Mountains Wilderness (CMW) by patenting its mining claims. ASARCO asserts its rights to mine the deposit and use federal lands for milling and storage purposes through both patented and unpatented mining claims.

ASARCO used the information collected during exploration to define the Rock Creek deposit as a valuable mineral deposit containing copper and silver. The 1872 Mining Law gives ASARCO the right to mine this deposit and remove the copper and silver. ASARCO's purpose is to make a profit from the mining and milling of copper and silver from the Rock Creek deposit. Society needs and demands these metals for a variety of purposes, ranging from industrial and medical to personal items, such as jewelry.

The Rock Creek Project is a proposed underground copper/silver mine and mill/concentrator complex in northwestern Montana. The project is proposed and would be operated by ASARCO, Incorporated (ASARCO). The Rock Creek ore deposit is located in Sanders County, Montana, beneath and adjacent to the CMW in the Kaniksu National Forest (see **Figure 1-1**). The Kaniksu National Forest (within Montana) is administered by the Kootenai National Forest, hereinafter referred to as KNF. The mill and other facilities would also be located within the Kaniksu National Forest in Sanders County. Access to the proposed project site would be via Montana Highway 200, then approximately 6 miles up Rock Creek Road (Forest Development Road No. 150).

An exploration adit would be driven for sampling the ore body, and for exhaust ventilation during mining. Access to the mineralized zone under the CMW would be via twin adits driven from outside the wilderness area. A fourth adit may be constructed for ventilation intake with a portal in the CMW. The

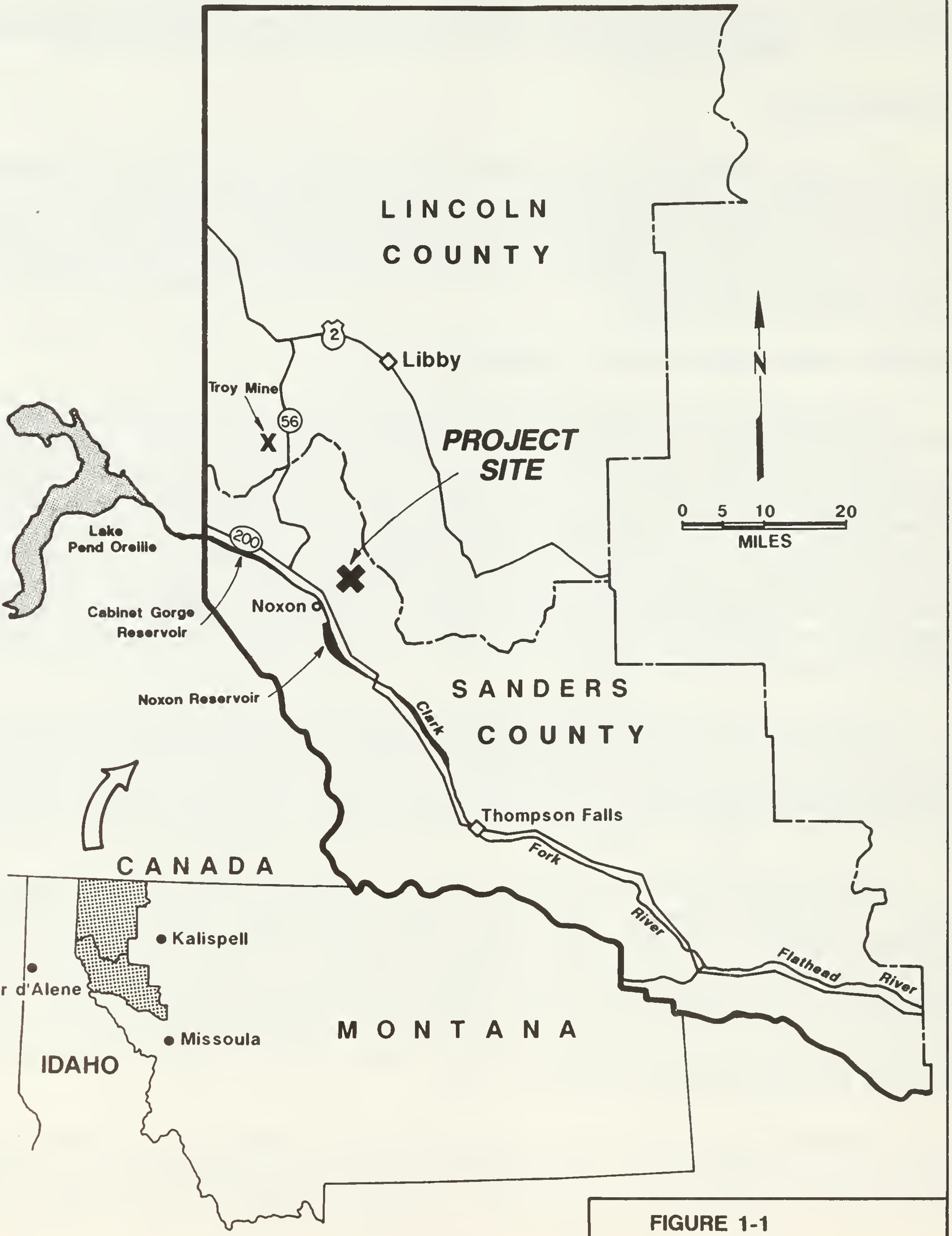

FIGURE 1-1
Location Map
Rock Creek Project
Sanders County, Montana

underground mining operation would use a room-and-pillar mining method where pillars of ore are left in place to support the rock above the room (see Chapter 2, Mine Plan). The milling process would use a conventional froth flotation process, producing a copper/silver-based concentrate that would be shipped to a smelter by rail. The material left after copper and silver were extracted is called "tailings"; tailings would be deposited in a tailings impoundment behind a dam.

Copper/silver mineralization in the Rock Creek drainage within the Cabinet Mountains was discovered in 1963 by Bear Creek Mining Company during regional reconnaissance. In 1964, the Cabinet Mountains were made part of the national wilderness system. The Wilderness Act allowed mineral exploration until January 1, 1984. From 1966 to 1973, Bear Creek Mining Company drilled ten holes to further verify the discovery. In 1973, ASARCO acquired the rights to the property as part of the lease agreement for the Troy Mine property. In the same year, a program of geological mapping, geochemical sampling, and drilling was started. The exploration program culminated with a total of 121 drill holes.

On January 1, 1984, the wilderness was withdrawn from mineral entry under provisions of the Wilderness Act, subject to valid existing rights. The Wilderness Act requires the Forest Service to assure that valid rights exist prior to approving mineral activities inside a congressionally designated wilderness area. To establish valid existing rights, mining claimants must show they have made a discovery of a valuable mineral deposit on the claim(s) prior to the withdrawal date, and maintain that discovery. In 1985, the Forest Service determined that ASARCO had established valid existing rights to the deposit. In 1989, the Bureau of Land Management (BLM) responded to ASARCO's patent application by issuing patents to 99 lode mining claims (1,686 acres within the CMW and 123 acres outside the CMW). ASARCO received a patent only to the minerals within the wilderness with the federal government retaining the surface rights. For those claims outside the wilderness, ASARCO received fee title (surface and mineral rights). ASARCO also controls at least 138 unpatented mining claims and owns 754 acres of fee land within the proposed project area (see Chapter 2, Mine Plan).

On May 6, 1987, ASARCO submitted a Plan of Operations/Application for a Hard Rock Operating Permit to KNF and Montana Department of State Lands (DSL). This multi-volume document was intended to meet the requirements of both agencies. ASARCO's[1] permit application contains environmental baseline information and operation and reclamation plans. Descriptions of proposed mining and milling methods, engineering designs, surface facilities, waste disposal practices, erosion and pollution control systems, reclamation methods, and environmental monitoring procedures are included. The application was initially deemed complete by KNF and DSL (the Agencies) on November 17, 1989. In June 1992, ASARCO submitted an application to the Agencies for the development of an exploration adit. The exploration license application was determined to be complete on July 26, 1993. Both these documents are available for public review at DSL, KNF, and selected libraries in the area. A decision on both the mining permit and exploration applications will be made after the EIS process is complete.

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[1] In 1992, several years after submitting an application for a Hard Rock Operating Permit and proposing a plan of operations to the Forest Service, ASARCO applied to DSL for an exploration license to access their ore body via an adit. The purpose of the adit is to evaluate the ore zones and structures, obtain rock mechanics data, and to obtain a bulk ore sample for metallurgical testing (ASARCO, Incorporated 1992). Throughout the draft EIS, the Agencies refer to this adit as ASARCO's exploration adit. By the use of this term, the Agencies do not intend for it to be confused with the term "exploration" within the meaning of federal mining laws.

THE EIS PROCESS

KNF adherence to National Environmental Policy Act (NEPA) regulations (40 CFR parts 1500 to 1508) attempts to minimize adverse environmental impacts on National Forest surface resources through informed decision making. Compliance with all other applicable federal and state laws and regulations is also mandatory. Furthermore, KNF would take all practical measures to harmonize operations with scenic values and maintain and protect fisheries and wildlife habitat that may be affected by the operations. KNF must also ensure timely interim and final reclamation on National Forest System (NFS) lands.

DSL adheres to Montana Environmental Policy Act (MEPA) regulations (ARM 26.628 to 663). DSL requires protection of air and water quality as well as successful interim and final reclamation of disturbed areas, and compliance with other applicable federal and state laws and regulations.

This EIS presents the Agencies' analysis of environmental impacts under NEPA and MEPA regulations and guidelines. The Agencies will use the analysis to make final permitting decisions concerning the operating permit and plan of operations. Under NEPA and MEPA, KNF and DSL are required to consider reasonable alternatives to a proposed project. The selected alternative will be in compliance with Corps the Engineer's (COE) and Environmental Protection Agency's (EPA) regulations and guidelines (33 CFR, Appendix B, 40 CFR 230, 404 (b)(1) guidelines).

Procedures governing the EIS process in Montana are defined in administrative rules implementing NEPA and MEPA. These laws require that if any action taken by the federal government or the state of Montana may "significantly affect the quality of the human environment,"[2] an EIS must be prepared. This draft EIS was written to meet the requirements of these statutes and the administrative rules and regulations implementing these laws.

The EIS process involves several steps that are summarized as follows:

1. The public is afforded the opportunity to identify issues and concerns by participating in a public scoping meeting and by submitting written comments. Issues and comments are then addressed in the draft EIS.
2. The proposed action and reasonable alternatives are summarized in the draft and final EISs.
3. Environmental resources that may be affected by the proposed action or alternatives are described in the draft and final EISs.
4. Analyses of the impacts of the proposed action and alternatives are conducted and the results are presented in the draft EIS.

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[2] As defined in 40 CFR 1508.27 and ARM 26.2.644 (see Appendix A).

5. A public review and comment period, including a public meeting, occurs after publication of the draft EIS. Substantive comments are addressed in the final EIS.

6. The final EIS is published and used by the Agencies to make decisions on the proposed action or alternatives.

7. A record of decision (ROD) is prepared by each Agency describing its decision, stating how the decision was made, and identifying required mitigation and monitoring measures and stipulations if an action alternative is selected.

AGENCY ROLES AND RESPONSIBILITIES

During the preparation of this draft EIS, the Montana Legislature created a new Department of Environmental Quality, integrating portions of DSL and Department of Health and Environmental Sciences (DHES) into the new department. Hereinafter, whenever DSL and DHES are referred to, it should be noted that after July 1, 1995, these references pertain to the new department.

Two "lead" agencies have been designated for this project: KNF and DSL (the Agencies). A single EIS for the Rock Creek Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. In addition to approvals by the Agencies required for the Rock Creek Project, various other permits, licenses, or approvals from other agencies also would be necessary (see **Table 1-1**) prior to construction and operation of the proposed project. The roles and responsibilities of the agencies with primary environmental permitting and regulatory responsibilities are discussed in the following sections.

Lead Agencies

Kootenai National Forest

A majority of the proposed Rock Creek Project facilities and all of the ore deposit are on or under lands administered by KNF. The Organic Administration Act authorizes the Secretary of Agriculture to regulate occupancy and use of NFS lands for the protection and management of forest resources. Regulations for mining and reclamation activities on NFS lands are contained in 36 CFR Part 228, Subpart A (36 CFR 228A). These regulations require submittal and approval of a proposed plan of operations for mining related activities that could result in significant disturbance to surface resources. Regulations for special uses on NFS lands are contained in 36 CFR 251. These regulations require that a special use application be filed for uses such as constructing and operating a transmission line. Both sets of regulations require that an applicant describe the proposed operation, environmental protection measures, and reclamation plans. Several additional permits associated with a variety of uses are required.

TABLE 1-1. Permits, Licenses, and Approvals Required for the Rock Creek Project.

Permit, License or Approval	Purpose
	Federal Agencies
	Kootenai National Forest
Approval of Plan of Operation (36 CFR 228A)	To allow ASARCO to construct and operate a mine and related facilities on NFS lands. Approval incorporates management requirements to minimize or eliminate effects on other forest resources which includes final design of facilities, and mitigation and monitoring plans. Coordinated with DSL and other appropriate agencies. KNF approval is documented in a ROD but will be contingent on KNF approval of final designs and plans prior to project implementation.
Special Use Permit(s)	To allow respective utility companies to construct and operate electric transmission/distribution and telephone lines and to allow ASARCO to construct and maintain associated facilities such as a weather station or radio tower outside the designated project area on NFS lands.
Road Use Permit	To specify operation and maintenance responsibilities on National Forest roads used for commercial hauling of ore concentrate.
Mineral Material Permit	To allow ASARCO to take borrow material from NFS lands outside mining claims or mill sites.
Timber Sale Contract	To allow ASARCO to harvest commercial timber from the project area within NFS lands. Harvesting would be conducted to clear area for project facilities.
	U.S. Fish and Wildlife Service (USFWS)
Biological Opinion	To evaluate jeopardy to threatened and endangered species. Consultation with KNF.
	U.S. Army Corps of Engineers
404 Permit (Clean Water Act)	To control discharge of dredged or fill material into waters of the U.S. including wetlands. Reviewed by EPA, USFWS, and Department of Health and Environmental Sciences (DHES).
	State and Local Agencies
	Department of State Lands
State Operating Permit (Metal Mine Reclamation Act)	To allow mining development activity. Proposed activity must comply with state and federal environmental standards and criteria. Approval includes stipulations for final design of facilities, and monitoring plans. Coordinate with KNF and DHES.
Reclamation Bond	To post a sufficient bond with the state prior to starting construction. Coordinate with Forest Service.
Timber Harvest	To ensure best management practices are used during timber harvest on private and state lands.

Table 1-1. Permits, Licenses, and Approvals Required for the Rock Creek Project (Cont'd)

Permit, License or Approval	Purpose
	Department of Health and Environmental Sciences
Air Quality Permit (Clean Air Act)	To control particulate emissions of more than 25 tons per year.
Burning Permit	To regulate slash burning from land clearing during construction.
Montana Pollutant Discharge Elimination System (MPDES) Permit (Water Quality Act)	To establish effluent limits, treatment standards, and other requirements for point source discharges to state waters.
Storm Water Discharge Permit (Water Quality Act)	To control discharge of storm waters from the mine site.
Public Water and Sewer Permit	To allow construction of public water and sewer system and to protect public health.
Water Quality Waiver of Turbidity	To allow for short-term increases in surface water turbidity during construction.
401 Certification (Federal Clean Water Act)	To ensure that any activity that requires a federal license or permit complies with Montana water quality standards.
Hazardous Waste Registration	To ensure safe transport of hazardous materials to and from the site.
	Department and Board of Natural Resources and Conservation
Water Rights Permit (Montana Water Use Act)	To allow beneficial use of state waters obtained through any surface water diversion over 35 gpm or through ground water withdrawal exceeding 100 gpm.
	State Historic Preservation Office
Cultural Resource Clearance (Section 106 Review)	To ensure appropriate protection of cultural resources (archeological and historic) coordinated with KNF.
	Department of Fish, Wildlife and Parks
FG Form 124 (Natural Streambed and Land Preservation Act)	To allow construction activities within the mean high water line of a perennial stream or river on public land.
	Montana Department of Transportation
Business Approach permit	To allow safe connection of roads to state highways.
	Hard Rock Impact Board/Sanders County
Fiscal Impact Plan (Hard Rock Mining Impact Act)	To mitigate fiscal impacts on local government services.
	Green Mountain Conservation District
310 Permit (Natural Streambed and Land Preservation Act)	To allow construction activity within the mean high water line of a perennial stream or river on private land.
	Sanders County Weed District
Noxious Weed Management Plan	To prevent propagation of noxious weeds.

The KNF Supervisor will issue a decision on ASARCO's proposal in a ROD (see Agency Decisions). ASARCO may appeal the decision pursuant to 36 CFR Part 215 or 251. Other parties wishing to appeal the decision may do so in accordance with appeal procedures provided in 36 CFR Part 215.

KNF would share responsibility for monitoring and inspecting the Rock Creek Project with DSL. KNF also has authority to ensure that impacts to surface resources on NFS lands are minimized by modifications to an approved plan of operations. Both KNF and DSL have authority to require a bond to ensure that the lands involved with the mining operation are reclaimed in accordance with the approved reclamation plan. (DSL's bonding is discussed in a subsequent section.) The bond would be held to ensure compliance with the state permit and Forest Service-approved plan of operations. KNF may require an additional bond if it determines that the bond held by DSL is inadequate to reclaim NFS lands or would be administratively unavailable to meet Forest Service requirements.

KNF is required by the Endangered Species Act to ensure that any actions it approves will not jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of critical habitat. KNF has prepared a draft biological assessment that evaluates the potential effect on threatened or endangered species that may be present in the area. The evaluation includes any measures KNF believes are needed to minimize or compensate for effects on the species. The biological assessment is presented in **Appendix B**. It will be submitted to the USFWS as part of a formal consultation process. In addition, KNF is required by the National Forest Management Act to maintain viable populations of sensitive species and to prepare biological evaluations to analyze impacts on sensitive species.

Montana Department of State Lands

Reclamation Division. DSL administers the Montana Metal Mine Reclamation Act (Title 82, Chapter 4, Part 3, MCA), under which ASARCO has applied for a mine operating permit (ASARCO, Incorporated 1987-1994). The purpose of this law is to prevent land and surface water degradation by requiring lands disturbed by mining, whether they be federal, state, or private, to be stabilized and reclaimed. The Metal Mine Reclamation Act requires an approved operating permit for all mining activities on non-Indian lands that disturb more than 5 acres, or mine more than 36,500 tons of ore annually.

DSL must decide whether to issue ASARCO an operating permit, and if so, under what conditions (see Agency Decisions). The Director of the Department of Environmental Quality (formerly Montana State Land Commissioner) may make a decision to approve ASARCO's permit application no sooner than 15 days following publication of the final EIS. A reclamation performance bond must be posted with DSL before an operating permit may be issued.

DSL is authorized to bond mining operations under the Metal Mine Reclamation Act (82-4-338, MCA). The bond amount (established by DSL and KNF) must be sufficient for the state to complete reclamation in case of default by ASARCO. DSL reclamation bonds include the cost of returning the site to comparable stability and utility, and other assurances that there would be no continuing impacts to the environment. Consequently, neutralization of chemicals or long-term water treatment are often a part of the bonding calculations. Bonding for water management and treatment is based on the volume of water that must be managed and/or treated, expected water quality, and the method to be used. The bond could be in the form of a trust fund or other mechanism to cover possible long-term facility maintenance and operation.

The amount of bond for reclamation is site specific. Calculations are based on the costs of reclaiming roads, parking lots, embankments, diversion channels, ponds, impoundments, and other facilities. Costs involve replacing topsoil on all disturbed areas. Costs for reclamation depend on the volume of material required for regrading, the distance the material must be moved, and volumes of and distances to move topsoil for proper placement. In addition, if any capping materials or other special handling or treatment are required as a part of the reclamation plan, those volumes and distances hauled are part of the calculation. Bond calculations also include the costs of revegetation, fertilization, temporary irrigation, removal of buildings and other structures, portal plugging, and restriction of access to the site. Bonding includes monitoring for as long as necessary after mine closure, and costs for reasonably foreseeable accidents. The calculations also include 15 percent overhead costs. The bond must be submitted by the applicant prior to permit issuance. Bonds are calculated once an alternative has been approved. The calculation would then be on file and available for public review.

Major changes in operating or reclamation plans would require prior approval by DSL and KNF, and additional bonding. DSL would routinely conduct inspections of the Rock Creek Project to ensure compliance with approved plans. Monitoring data collected by ASARCO would be evaluated and, if necessary, additional compliance activities would be implemented. Monitoring activities would be coordinated with other state and federal agencies. DSL can issue notices of violation and levy civil penalties of up to $1,000 per day of violation to enforce its regulations (82-4-361, MCA).

Other Federal Agencies Having Permit or Review Authority

U.S. Fish and Wildlife Service (USFWS)

USFWS has responsibilities under the Endangered Species Act and the Bald Eagle Protection Act. The Forest Service must prepare a biological assessment to comply with the Endangered Species Act. A biological assessment evaluates potential effects on threatened and endangered species that may be present in the project area. After review of the biological assessment and other relevant data, the USFWS will render a biological opinion. That opinion will state whether, in the view of USFWS, the action is likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or modification of critical habitat. If USFWS determines that the preferred alternative would jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative that would, if implemented, preclude jeopardy. The USFWS has 135 days from initiation of formal consultation to render the biological opinion.

U.S. Army Corps of Engineers (COE)

Tailings disposal and other mine facility construction activities affecting wetlands would constitute the disposal of dredged or fill materials into Waters of the U.S. and would require a "404 permit" under Section 404 of the Clean Water Act. COE is the permitting authority for the discharge of dredged or fill materials into the Waters of the U.S (see Chapter 3, Waters of the U.S. and Wetlands). ASARCO submitted a 404 permit application (see evaluation in **Appendix C**) to COE (ASARCO, Incorporated 1993) for its proposed project and will resubmit an updated application and wetland mitigation plan for the Agencies' preferred alternative identified in this draft EIS. COE will document its 404 permit decision in its ROD.

COE and EPA have developed guidelines to evaluate impacts from dredged or fill disposal activities on Waters of the U.S. (33 CFR Part 320 and 40 CFR Part 230) and to determine compliance with Section 404 of the Clean Water Act. The guidelines require analysis of "practicable" alternatives that would not require disposal of dredged or fill material in Waters of the U.S., or that would result in less environmental damage. Under the guidelines, the term "practicable" means "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

Environmental Protection Agency (EPA)

EPA has oversight responsibility for federal Clean Water Act programs delegated to and administered by the state Water Quality Division. EPA may also intervene to resolve interstate disputes where discharges of pollutants in an upstream state may affect water quality in a downstream state. EPA also reviews 404 dredge and fill permit applications and provides comments to COE. EPA has veto authority under the Clean Water Act for decisions made by COE on 404 permit applications. EPA also has responsibilities under NEPA and the Clean Air Act to cooperate in the preparation of EISs and to review draft EISs and federal actions potentially affecting the quality of the environment. EPA advises the lead agencies on the preparation of an EIS. EPA also evaluates the adequacy of information in the draft EIS, the overall environmental impact of the proposed action, and various alternatives.

Other State and Local Agencies Having Permit or Review Authority

Montana Department of Health and Environmental Sciences (DHES)

DHES administers the Montana Clean Air Act (75-2-101 et seq., MCA), the Montana Water Quality Act (75-5-101 et seq., MCA), the Montana Hazardous Waste Act (75-10-401 et seq., MCA), and the Solid Waste Management Act (75-10-201, et seq., MCA). DHES also provides 401 certification for the COE regarding ASARCO's 404 permit application (see U.S. Army Corps of Engineers).

Air Quality Division. This division administers the Montana Clean Air Act. Any proposed project having estimated pollutant emissions (without emissions controls) exceeding 25 tons per year must obtain an air quality permit. The permit would specify air emissions limitations and monitoring requirements. The applicant must apply Best Available Control Technology to each emissions source, and must demonstrate that the project would not violate Montana or federal Ambient Air Quality Standards. The Air Quality Division would conduct periodic inspections to ensure permit compliance. Civil violations of the Montana Clean Air Act may result in penalties of up to $10,000 per violation per day (75-2-413, MCA) as well as non-compliance penalties (75-2-421, MCA).

Water Quality Division (WQD). This division is responsible for administration of the Montana Water Quality Act. This law provides a framework for the classification of surface and ground water uses. It also establishes water quality standards as well as permit programs to control the discharge of pollutants into state waters. WQD administers Montana Pollutant Discharge Elimination System (MPDES) permitting which includes storm water permits. Mining operations must comply with Montana surface and ground water standards. The tailings impoundment, sewage treatment plant, and other facilities must be constructed and operated to prevent water discharge, seepage, drainage, infiltration, or flow that may degrade surface or ground waters. A short-term exemption from surface water quality standards for turbidity may be required for construction of the powerline and access roads at stream crossings. WQD has the responsibility for enforcement under the Water Quality Act. Enforcement actions may include civil penalties of up to $25,000 per day of violation (75-5-631, MCA).

ASARCO submitted a revised water management plan and MPDES permit application in March 1995. The permit application requests coverage for two sources: a direct discharge to the Clark Fork and the discharge to ground water below the tailings impoundment. A draft discharge permit containing effluent limits and conditions, monitoring requirements, and where applicable, a mixing zone will be issued by WQD. Storm water discharges will also be incorporated into the MPDES permit. Discharge permits are issued for a period of up to 5 years and are renewable in 5-year cycles. A public notice will be given upon issuance of the draft permit followed by an opportunity for public comment and hearing.

Because of the design of the tailings impoundment and recovery well system, the discharge permit will specify a mixing zone in ground water in accordance with Montana's mixing zone rules (ARM 16.20.701 et seq.). A mixing zone is an area of initial dilution where water quality standards may be exceeded subject to conditions that may be imposed in the permit. Nondegradation does not apply within a mixing zone. Mixing zones must be the smallest practicable size, have a minimum effect on water uses, and have definable boundaries.

Section 401 of the federal Clean Water Act (33 U.S.C. 1251 et seq.) requires that applicants for federal permits or licenses for activities that may result in a discharge to state waters obtain certification from the state. The 401 certification process ensures that discharges that otherwise do not require a state permit comply with applicable state water quality standards and that there would be no violation of state law if a 404 permit was approved. In Montana, WQD provides Section 401 certification pursuant to state rules (ARM 16.20.1701 et seq.). DHES may deny certification for a project if it would violate Montana water quality standards, based on DHES analysis. DHES may also certify, certify with conditions, or waiver certification. Certifications may be appealed to the Board of Health and Environmental Sciences within 30 days of final action by the department. Section 404 dredge and fill permits issued by COE require 401 certification. A joint public notice is issued by COE and DHES.

Waste Management Division. This division is responsible for reviewing the mine and transmission line construction and operation plans to ensure implementation complies with solid and hazardous waste laws and regulations. Maximum penalties for hazardous waste violations are $10,000 per violation per day (75-10-417, MCA). Maximum penalties for solid waste violations are $1,000 per violation per day (75-10-214, 228, and 233, MCA).

Montana Department of Natural Resources and Conservation (DNRC)

DNRC administers the Montana Water Use Act (85-2-101 et seq., MCA). A water rights permit is required by the Montana Water Use Act for any surface water diversion over 35 gallons per minute (gpm) or a ground water withdrawal exceeding 100 gpm. Because ASARCO proposes to pump water from Clark Fork alluvium, a water rights permit would be required.

Montana Department of Fish, Wildlife and Parks (DFWP)

DFWP administers the Natural Streambed and Land Preservation Act (75-7-101 et seq., MCA), and cooperates with DHES in water quality protection matters. Any project proposal that would affect the bed and banks of Rock Creek and its tributaries would require a 124SPA permit with mitigation provisions. Reconstruction of road drainage structures, habitat improvements, new stream crossings, and creek diversions are examples of activities needing a permit from DFWP.

As the lead agency for management of fisheries resources in Montana, DFWP also administers the use, enjoyment, and scientific study of fish. DFWP's approval and designation of a licensed collector as field supervisor would be required for monitoring, mitigation, and transplanting of fish within the project area.

State Historic Preservation Office (SHPO)

Compliance with federal cultural resource protection laws is required because portions of the proposed project occur on NFS lands. Actions that are permitted, approved, or initiated by the Forest Service and that may affect cultural resources must comply with provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and as implemented by federal guidelines 36 CFR 800. Section 106 of the NHPA requires a federal agency to take into account the effects of the agency's undertaking on properties listed on, or eligible for listing on, the National Register of Historic Places (NRHP).

Before any federal undertaking begins, cultural resources eligible for listing on the NRHP must be identified and documented. Cultural resources recorded in the project area are evaluated in consultation with SHPO or the Federal Advisory Council on Historic Preservation (ACHP). Agreements reached between the Forest Service and the consulting parties on eligibility constitute a consensus, allowing the compliance process to proceed. If sites do not meet the criteria of eligibility for the NRHP, no further consideration of cultural resources is necessary and the project may proceed.

If a site meets any of these criteria, the Forest Service is required to determine the effect of the proposed action on the site. Once consulting parties agree on mitigation measures for eligible properties affected and the conditions or stipulations have been met, the project may proceed. During mine construction and operation, the Agencies would oversee compliance with historic preservation and monitoring plans.

Montana Department of Transportation (MDT)

MDT must review requests for an approach road (60-2-201, MCA). This code lists the criteria required to assure a reasonably safe approach road for connection with the state highway system (Steve Herzog, Montana Department of Transportation, personal communication, October 13, 1994).

Hard Rock Mining Impact Board/Sanders County

In 1981, the Montana legislature enacted the Hard Rock Mining Impact Act (90-6-301 et seq., MCA) to assist local governments in handling financial impacts caused by large-scale mineral development projects. The legislature recognized that 1) new mineral development projects may result in the need for local governments to provide additional services and facilities causing a fiscal burden for local taxpayers, before mine-related revenues become available; and 2) some local government units may lack jurisdiction to tax a new development. Therefore, the Hard Rock Mining Impact Board (part of the Montana Department of Commerce), oversees an established process for identifying and mitigating fiscal impacts to local governments. The Board also acts as "referee" in disputes between local governments and project developers.

A public hearing on the impact plan is held by the county where fiscal impacts are forecasted to be the most costly. Sanders County will be the lead local governing body responsible for reviewing and commenting on ASARCO's Hard Rock Mining Impact Plan for the Rock Creek Project. However, Lincoln County will probably also review and comment. The process is described in 90-6-307, MCA.

The operating permit issued by DSL is not valid until an impact mitigation plan has been approved by the Hard Rock Mining Impact Board. The impact mitigation plan to be submitted by ASARCO before the final EIS is issued would identify the increased public sector costs associated with major mineral development. It would also contain commitments to pay (prepayment of taxes), grants, and other options according to a specified time schedule, all increased capital and net operating costs to local government units that result from project development.

Green Mountain Conservation District

Any mining disturbance occurring within the normal high water level of streams outside of KNF boundaries would require the approval of the Green Mountain Conservation District. This approval would constitute a "310 permit" under the Natural Streambed and Land Preservation Act (75-7-101 et seq., MCA). Prior to granting approval, the District would consult with KNF and DFWP.

Sanders County Weed Board

The weed board administers the County Noxious Weed Control Act (7-22-2101 through 2153, MCA) for any land-disturbing activities within their jurisdiction. ASARCO would be required to submit a weed management plan to Sanders County Weed Board for review and approval.

AGENCY DECISIONS

DSL will decide on ASARCO's mine permit application in consultation with DHES. KNF will decide on ASARCO's project proposal after decisions by DHES and USFWS. COE will approve or deny the 404 permit after KNF issues its ROD. Approvals would be based on information in this document and compliance with other state and federal environmental laws.

Grounds for DSL denial would be a finding that the mining or reclamation plans would violate the laws administered by DSL (primarily the Metal Mine Reclamation Act), or the water and air quality laws administered by DHES. No authority exists for the Forest Service to deny ASARCO the right to develop the ore deposit unless its plan of operations violates laws. A plan of operations, however, must meet the purpose of the Forest Service locatable mineral regulations as described in 36 CFR 228A. These regulations state, in part, that all operations shall be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources, including complying with all applicable federal and state air and water quality standards, and standards for the disposal and treatment of solid wastes. All practicable measures must be taken to harmonize operations with scenic values and maintain and protect fisheries and wildlife habitat that may be affected by the operation. The Rock Creek Project cannot proceed if the USFWS decides, in its official opinion, that the project could not be conducted without jeopardizing the continued existence of a threatened or endangered species. COE can deny a 404 permit if the project would result in significant environmental impact or violate provisions of the Clean Water Act.

PUBLIC PARTICIPATION

Public participation has been a key element in preparing this draft EIS (see **Table 1-2**). The first opportunity for public involvement occurred in the beginning of the EIS process when "scoping" was conducted. Scoping is a process designed to identify a broad list of environmental issues related to the proposed action. Scoping was again conducted when preparation of the EIS was resumed after a 4-year lapse. Scoping comments are included in **Appendix D**. The Agencies determined the significant issues from those identified during the two scoping periods. The subsequent analyses presented in this EIS focus on the identified significant issues. A summary of issues is presented in Chapter 2.

TABLE 1-2. Public Meetings

May 26, 1987	Public information meeting held on ASARCO's application in Noxon, Montana.
January 27, 1988	Public scoping meeting on ASARCO's application at Noxon, Montana.
March 22, 1990	Public meeting on ASARCO's petition to amend ambient water quality at Noxon, Montana.
June 16, 1993	Public scoping meeting in Noxon, Montana.
June 28, 1993	Public scoping meeting in Sandpoint, Idaho.

CHAPTER 2

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CHAPTER 2: DESCRIPTION OF ALTERNATIVES

INTRODUCTION

This chapter summarizes ASARCO's proposed plan for its Rock Creek Project, a copper/silver mine, mill, tailings storage facility, and exploration adit. Reasonable alternatives to the proposed action, including the no-action alternative, are also described. Part I of this chapter, Issues and Development of Alternatives Process, describes how Kootenai National Forest and Department of State Lands (the Agencies) developed alternatives analyzed in this draft EIS. Part II, Description of Alternatives, describes ASARCO's project proposal and three alternatives, including the no-action or permit denial alternative. Part III, Alternatives Considered but Dismissed from Further Study, describes alternatives considered but dismissed from detailed analysis in this draft EIS as well as the rationale for their dismissal. Part IV, Reasonably Foreseeable Activities, discusses the reasonably foreseeable future activities included in the project area. These include the proposed Plum Creek Checkerboard Land Exchange, road closures, timber harvest, the Montanore Project, and other activities. Part V, Comparison of Alternatives, compares the features and impacts of each alternative to the issues used for alternative development. Part VI identifies the Agencies' preferred alternative.

PART I: ISSUES AND DEVELOPMENT OF ALTERNATIVES PROCESS

Identification of Issues

The Agencies identified the significant issues that would be used as criteria in defining and evaluating the alternatives from written comments and a series of public and agency meetings. Eight issues, defined as indicators of potentially significant effects, emerged from the scoping process and Agencies' discussions. The effects have the potential to be adverse or beneficial, to be severe or long-lasting, to affect a large area, or to occur frequently when a resource's quantity, quality, fragility, or uniqueness are considered. In the following sections, only issue headings will be repeated in the discussion under each alternative. The description of each issue and the means for predicting its associated impacts are provided below and do not represent a conclusion about the effects of the project:

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

Discharges and activities associated with the Rock Creek Project may change the ambient (existing) surface water quality of Rock Creek, the Clark Fork River, and Lake Pend Oreille, and ground water quality. *Effects will be predicted by estimating changes in selected water quality parameters of surface and ground waters and changes in the composition and abundance of aquatic life.*

Seepage from the tailings impoundment may alter ambient ground and surface water quality. *Effects will be predicted by estimating changes in selected ground water quality parameters of selected wells.*

The proposed water withdrawals and diversions may affect existing water users. *Effects will be predicted by estimating changes in concentrations of selected parameters and the quantity of water available for users.*

Seepage into underground mine workings may affect water levels in wilderness lakes and flow rates of springs. *Effects will be predicted by estimating mine inflow and changes in lake levels and spring flows.*

Issue 2: Effects on fish and wildlife habitat and current and proposed threatened and endangered species.

The proposed mining activities and mining support activities may adversely affect grizzly bear (threatened species) because of direct habitat loss, displacement, disruption of travel routes, and increased mortality. *Effects will be predicted by estimating changes in open road density (miles of open road per square mile) and percent of each bear management unit that provides seclusion from humans.*

The proposed mining activity and mining support activities may adversely affect big game because of habitat loss or degradation, displacement, disruption of travel routes, and increased mortality risk. *Effects will be predicted by estimating changes in open road density, habitat quality, and mortality risk.*

The proposed mining activities and mining support activities may adversely affect neotropical migrant birds from habitat loss or degradation and displacement of species using the area. *Effects will be predicted by estimating acres of habitat altered.*

The proposed mining activities and mining support activities may adversely affect mountain goats because of habitat loss or degradation, displacement, disruption of travel routes, and increased mortality risk. *Effects will be predicted by estimating acres of habitat altered and changes in habitat quality and mortality risk.*

Disturbance from the proposed mining activities may affect other threatened and endangered species (bald eagle, peregrine falcon, and grey wolf) currently using the area. Threatened and endangered species may be subject to adverse habitat modification as well as to an increased mortality risk. *Effects will be predicted by estimating acres of habitat affected and changes in open road density.*

The proposed mining and support activities may adversely affect sensitive animal species (boreal owl, lynx, harlequin duck, fisher, black-backed woodpecker, northern bog lemming, and Coeur d'Alene salamander) due to habitat loss or degradation, displacement, disruption of travel routes, and increased mortality. *Effects will be predicted by estimating acres of altered habitat and changes in habitat quality and mortality risk.*

The proposed mining and support activities may affect sensitive fish species (westslope cutthroat and bull trout) and/or those proposed for listing as endangered. The effects on these species could include habitat loss or degradation, and increased mortality risk. *Effects will be predicted by estimating changes in surface and ground water parameters, changes in habitat quality, and changes in abundance and composition of aquatic life.*

Issue 3: Stability of the tailings impoundment.

Failure of the tailings impoundment may have substantial adverse effects on water quality, public safety, aesthetic quality, downstream facilities, aquatic life, and long-term reclamation success among others. A comprehensive Quality Control/Quality Assurance program should be part of any proposed design. Probability of failures can be measured by documenting foundation strength parameters, tailings properties, and seismic response. Phreatic surface location and associated seepage analyses will also be used in the technical review of the impoundment design. *Effects of failure can be predicted by estimating impacts to surface waters and aquatics/fisheries as described above.*

Issue 4: Impacts to socioeconomics of surrounding communities.

The proposed project may affect local employment, local income, the size and location of the area population, school, fire, public safety and other public services, local tax revenues, and public expenses. *Effects will be predicted by estimating changes in employment, population, demographics, government services, local economies, and fiscal condition in Sanders County.*

Issue 5: Effects on old growth ecosystems.

The proposed project may impact old growth stands. *Effects will be predicted by estimating the acres of old growth affected and changes in old growth quality and effectiveness.*

Issue 6: Effects on Waters of the U.S. and wetlands.

The proposed project may destroy or affect wetlands and Waters of the U.S. *Effects will be predicted by estimating the number of acres destroyed, dewatered, or otherwise affected and by the net decrease in functions and values of the affected wetlands and Waters of the U.S.*

Issue 7: Effects on public access and traffic safety.

The proposed project could adversely impact public recreational access and use patterns such as hunting, berry picking, camping, sightseeing, and hiking. *Effects will be predicted by estimating the number/miles of roads closed/opened.*

Public safety is a primary concern on proposed service roads and Montana Highway 200. *Effects will be predicted by estimating changes in average daily traffic.*

Issue 8: Effects on aesthetic quality, including noise, scencic, and wilderness experiences.

The proposed mining and support activities may create noise that exceeds ambient levels. *Effects will be predicted by estimating changes in dBAs (decibels in the A scale) and significance of areas exposed to elevated noise levels.*

The proposed project may change the existing scenic quality and visual character of the Clark Fork Valley and Rock Creek drainage. *Effects will be predicted by the degree of compliance with Forest Service visual quality objectives, by analyzing visual contrast of proposed facilities with the existing landscape, and by estimating reclamation success.*

The portal of a ventilation adit is proposed in the wilderness. Wilderness users might notice sights, sounds, and smells from the proposed project that could affect their wilderness experience. *Effects will be predicted by those items listed above for noise and scenic quality and by estimating changes in concentrations of air pollutants (particulates and trace metals).*

Development of Alternatives

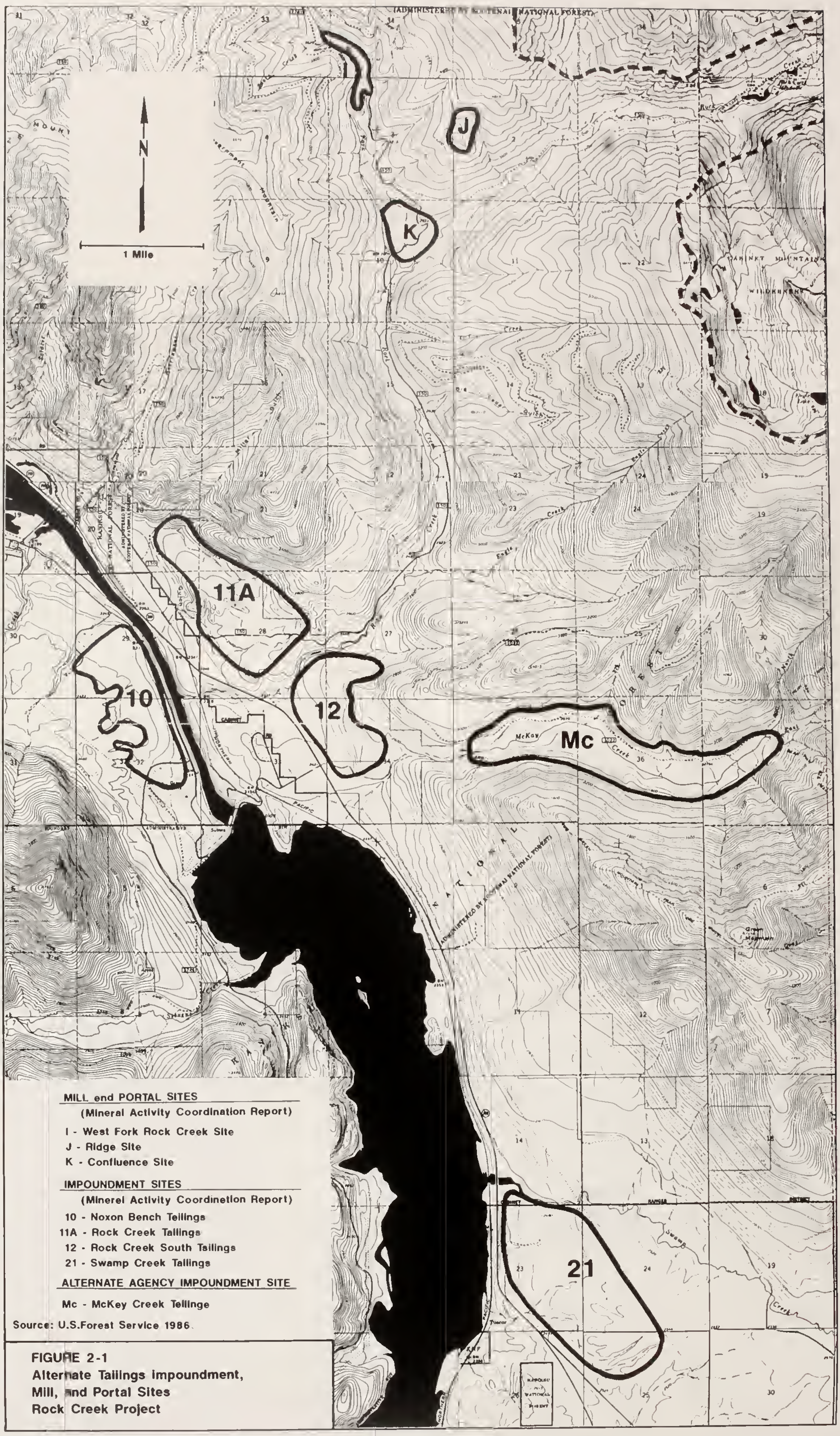
In an EIS, the Agencies are required to evaluate the environmental effects of the proposed action and reasonable alternatives to it. The Agencies must also consider a no-action alternative.

Alternatives other than the proposed action and the no-action alternative were developed by the Agencies in response to identified environmental issues. The intent of these alternatives was to minimize potential negative environmental impacts by modification of planned operations, mitigation and monitoring plans, and/or relocation of any or all of the proposed project facilities.

Other alternatives consist of reasonable modifications to various elements of the proposal. These modifications fall into two main categories -- those that modify the location of facilities and those that modify or change the methods and procedures employed in the operation. One or more modifications to different elements were combined in the Agencies' alternatives in order to address the significant environmental issues identified earlier. Mitigations are also proposed in conjunction with these modifications.

Location of Facilities

Alternate locations for each of the facilities were considered in response to issues and concerns associated with their respective siting. Alternate locations for a mine portal and mill site, tailings impoundment, ventilation portal, utility and road corridors, and rail sidings were considered.


N
1 Mile
J
K
11A
12
10
Mc
21
MILL and PORTAL SITES
(Mineral Activity Coordination Report)
I - West Fork Rock Creek Site
J - Ridge Site
K - Confluence Site
IMPOUNDMENT SITES
(Mineral Activity Coordination Report)
10 - Noxon Bench Tailings
11A - Rock Creek Tailings
12 - Rock Creek South Tailings
21 - Swamp Creek Tailings
ALTERNATE AGENCY IMPOUNDMENT SITE
Mc - McKay Creek Tailings

Source: U.S.Forest Service 1986.

FIGURE 2-1
Alternate Tailings Impoundment,
Mill, and Portal Sites
Rock Creek Project

Mine Portal and Mill Site. In 1986, KNF published the Mineral Activity Coordination (MAC) Report detailing the findings of a tailings and mill facility siting study conducted for the Cabinet Mountains (U.S. Forest Service 1986a). This study included an evaluation of various potential tailings and mill facility locations for the proposed ASARCO Rock Creek Project and the now-permitted Montanore Project, and other potential proposals in the south Cabinet Mountains area. The siting study identified seven potential mill sites for the Rock Creek Project: one site on the East Fork Bull River, one site on Copper Creek, and five sites in the Rock Creek drainage. Ultimately, three mill sites in the Rock Creek drainage were further evaluated (see **figures 2-1 and 2-2**). The reasons for dismissing the other sites are discussed in this chapter under Part III: Alternatives Considered but Dismissed From Further Study.

Issues addressed by mine portal and mill site alternatives include:

Issue 1:	Effects on quantity and quality of Montana and Idaho surface and ground water resources.
Issue 2:	Effects on fish and wildlife habitat and current and proposed threatened and endangered species.
Issue 5:	Effects on old growth ecosystems.
Issue 6:	Effects on Waters of the U.S. and wetlands.
Issue 7:	Effects on public access and traffic safety.
Issue 8:	Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Tailings Impoundment. The MAC Report identified potential sites for tailings disposal impoundments based on mill site locations. The following criteria were applied to identify potential tailings impoundment locations.

(1) Tailings location should be less than 10 miles from the mill site.

(2) Tailings location should be at a lower elevation than the mill site to provide gravity-assisted flow of a tailings slurry.

(3) Tailings location should have relatively gentle terrain (less than 10 percent slopes).

(4) Tailings locations should have foundation conditions that could be reasonably expected to support an impoundment facility.

(5) Use of the tailings location would not require diversion of a major stream.

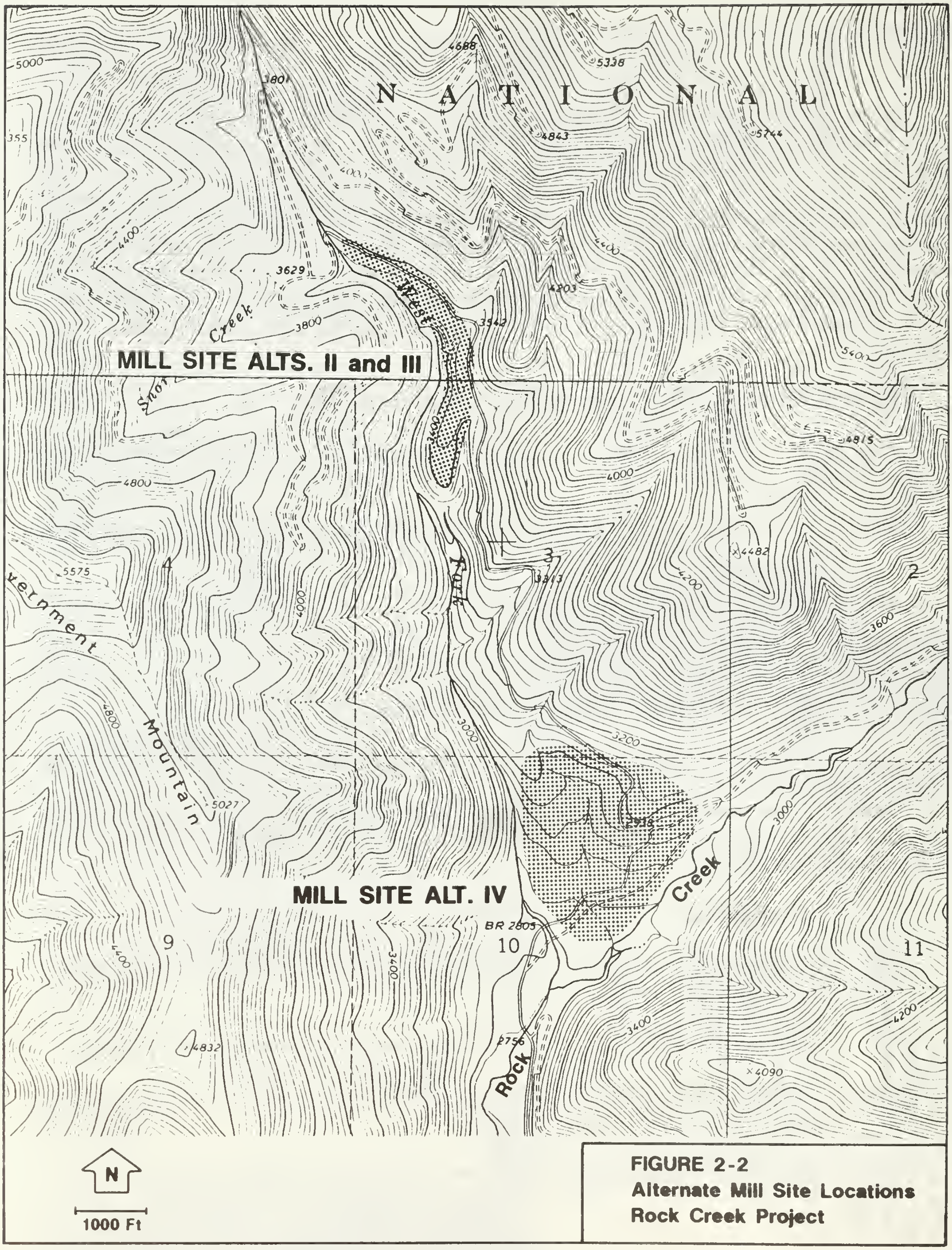


FIGURE 2-2
Alternate Mill Site Locations
Rock Creek Project

Potential siting options were also reviewed in detail by ASARCO. These initial reviews considered potential tailings disposal sites in conjunction with several potential locations for the mill facility. Aside from the criteria listed above, ASARCO used an added criterion: that there should be a relatively unobstructed transportation corridor between the tailings and mill sites.

As project definition proceeded, the possible locations for the mill were reduced to sites in the Rock Creek drainage, thereby eliminating the three tailings alternatives that were associated with the East Fork Bull River and Copper Creek mill locations. The MAC Report identified four alternative tailings sites for the proposed project with its mill located in the Rock Creek drainage (see **Figure 2-1**). The Agencies determined that only the proposed impoundment site met the MAC Report and ASARCO's criteria, and was large enough to contain all the tailings to be generated by the proposed project.

Subsequent to the MAC Report, the Agencies undertook another review of tailings impoundment siting options. This review combined construction method with location options to evaluate the potential for constructing specific types of tailings impoundments at several sites and the potential for using two sites simultaneously for tailings disposal. The McKay Creek site (see **Figure 2-1**) was included in this re-evaluation. These reviews are discussed in Alternatives Considered but Dismissed From Further Study.

Issues addressed by tailings impoundment siting alternatives include:

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

Issue 2: Effects on fish and wildlife habitat and current and proposed threatened and endangered species.

Issue 3: Stability of the tailings impoundment.

Issue 5: Effects on old growth ecosystems.

Issue 6: Effects on Waters of the U.S. and wetlands.

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Ventilation Adit. The Agencies identified an alternative to ASARCO's proposal to lessen impacts on the Cabinet Mountains Wilderness (CMW) by suggesting that the ventilation adit be located in a cliff area to minimize disturbed acreage.

Issues addressed by a ventilation adit alternative include:

Issue 2: Effects on fish and wildlife habitat and current and proposed threatened and endangered species.

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Utility and Road Corridors. ASARCO's proposed mine road and highway intersection does not meet current Montana Department of Transportation (MDT) standards so an alternative was developed. The Agencies combined road and utility corridors where possible to minimize resource impacts. The Agencies also analyzed alternative routes to access ASARCO's mine portal to avoid new road construction on steep slopes and unstable soils.

Issues addressed by utility and road corridor siting alternatives include:

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

Issue 2: Effects on fish and wildlife habitat and current and proposed threatened and endangered species.

Issue 5: Effects on old growth ecosystems.

Issue 6: Effects on Waters of the U.S. and wetlands.

Issue 7: Effects on public access and traffic safety.

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Rail Sidings. The Agencies analyzed alternatives that met Montana Rail Link criteria. Alternative rail sidings are further discussed in Alternatives Considered but Dismissed From Further Study. Ultimately, only one was chosen.

Issues addressed by rail siding alternatives include:

Issue 4: Impacts to socioeconomics of the surrounding communities.

Issue 6: Effects on Waters of the U.S. and wetlands.

Issue 7: Effects on public access and traffic safety.

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Methods and Procedures

Alternate methods and procedures for certain operations were also considered in response to issues and concerns. Two operations were identified where different methods or procedures were available for consideration. They were water treatment systems and impoundment construction.

Water Treatment Systems. ASARCO has proposed collection of tailings impoundment seepage with a perimeter recovery system consisting of drains and pump-back wells. Collected tailings seepage would be redeposited on the impoundment. The proposed method of water treatment includes pressure filtration, settling sumps, and a passive biotreatment system with an ion exchange plant for backup treatment. Alternative water treatment methods have been considered by the Agencies in response to the issues and concerns associated with the proposed operating plan. These include conventional water treatment facility, Land Application Disposal (LAD), constructed wetlands, and segregation of water. Changes to ASARCO's water monitoring plan have been developed.

Issues addressed by discharge water treatment alternatives include:

Issue 1:	Effects on quantity and quality of Montana and Idaho surface and ground water resources.
Issue 2:	Effects on fish and wildlife habitat and current and proposed threatened and endangered species.
Issue 8:	Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

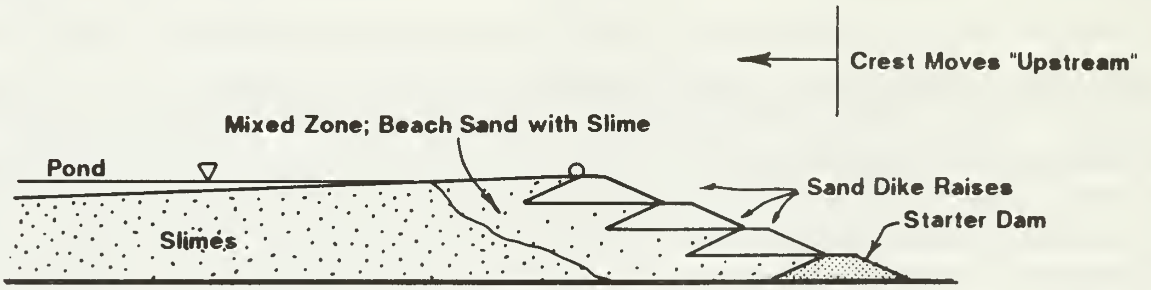
Impoundment Construction Methods. Various methods of tailings impoundment construction are reviewed in **Appendix E**. For the amount of tailings associated with the proposed action (100 million tons), only staged embankment construction was considered a viable method.

This type of tailings retention structure uses the sand portion of the tailings as its primary construction material. This tailings sand is sequentially added to the embankment in stages to build the dam that retains the tailings. There are three general categories of staged embankments. They are named according to the horizontal direction the crest of the dam moves during its construction lifetime; 1) upstream, 2) downstream, and 3) centerline. In addition, there are hybrid styles of construction, such as the modified centerline, that combine construction methods to adapt them to specific sites (see **Figure 2-3**).

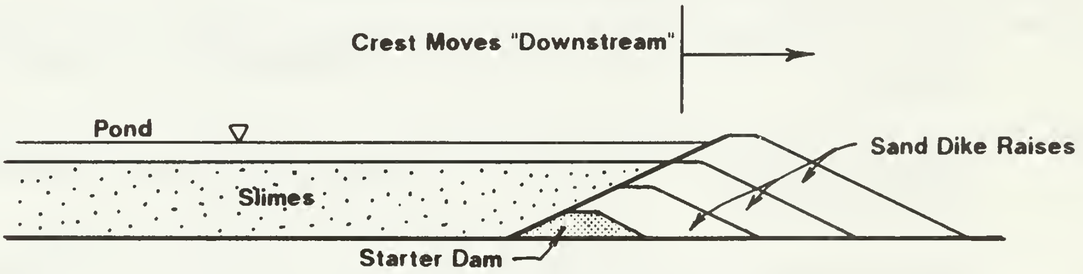
The Agencies reviewed the various construction methods to address concerns about stability and amount of disturbed area. Each construction method has corresponding seepage and drainage collection systems.

Issues addressed by impoundment construction alternatives include:

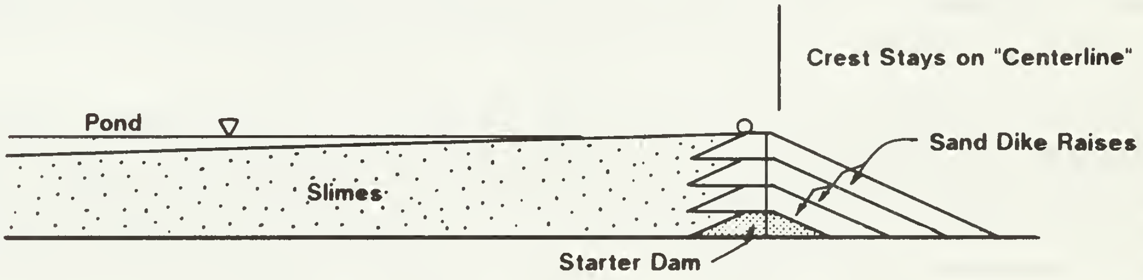
Issue 1:	Effects on quantity and quality of Montana and Idaho surface and ground water resources.
Issue 2:	Effects on fish and wildlife habitat and current and proposed threatened and endangered species.
Issue 3:	Stability of the tailings impoundment.



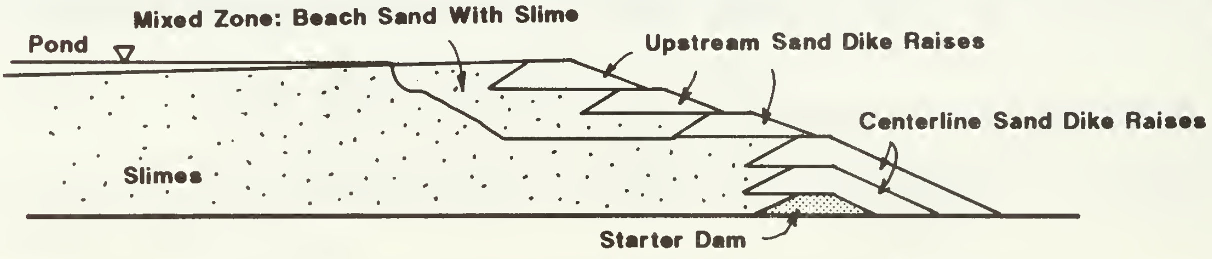
(a) Upstream Construction (Alternative II)



(b) Downstream Construction



(c) Centerline Construction


Mixed Zone: Beach Sand With Slime
Pond
Upstream Sand Dike Raises
Centerline Sand Dike Raises
Slimes
Starter Dam

(d) Modified Centerline Construction
(Alternatives III and IV)

FIGURE 2-3
Impoundment Construction Methods
Rock Creek Project

Issue 8: Effects on aesthetic quality, including noise, scenic, and wilderness experiences.

Alternatives Considered in the EIS

Four alternatives were carried forward for consideration in the draft EIS. Under Alternative I, the no-action alternative, the project would be denied or bought out by public agencies. The no-action alternative provides a baseline for estimating the effects of other alternatives.

Alternative II is ASARCO's proposed plan. ASARCO would construct, operate, monitor, and reclaim the Rock Creek Project as proposed in the plan of operation and applications. The Agencies would issue the necessary permits and approvals.

Alternative III consists of Agency-initiated modifications to ASARCO's mine proposal. The changes include:

- a different design for the tailings impoundment dam including agency technical panel review of the redesign;
- relocation of the intersection of Rock Creek Road (FDR No. 150) and Montana Highway 200;
- relocation of the rail siding to Miller Gulch;
- relocation of the wilderness ventilation adit;
- modified mine portal access; and
- rerouting of the utility and road (primarily FDR No. 150) corridors.

Mitigations include:

- geochemical and acid-base account testing;
- rock mechanics studies;
- measures to protect scenic resources;
- changes in reclamation/revegetation plans;
- measures to reduce noise levels;
- changes to grizzly bear mitigation;

- expanded monitoring for hydrology, soils and revegetation, fisheries/aquatics, and wildlife;
- a subsidence control and monitoring plan; and
- an aquatics/fisheries mitigation plan.

Alternative IV includes the mitigations and modifications from Alternative III. Additional modifications include:

- relocation of mine adits and mill site, subsequently reducing utility and road corridor length.

Additional mitigations due to the mill site relocation include:

- changes in the reclamation/revegetation plan;
- a 300-foot stream buffer around the mill site;
- a visual buffer between the mill site and FDR No. 150; and
- changes to grizzly bear mitigation (replacement acreage changes).

PART II: ALTERNATIVES DESCRIPTION

Alternative I -- No Action

Under this alternative, ASARCO would not develop the Rock Creek Project. The environmental, social, and economic conditions described in Chapter 3 would not be affected by the construction and operation of the project. Any existing disturbances by ASARCO would be reclaimed in accordance with existing laws and permits.

KNF and DSL currently do not have the authority to deny the project if the applicant demonstrates compliance with all applicable laws and regulations. National Forest System lands (NFS lands) outside wilderness are open to mineral entry under mining laws. Federal land policy facilitates production of mineral resources in an environmentally sound manner, and ensures lands are reclaimed.

ASARCO's property interests in the Rock Creek Project include both privately owned (patented) lands and unpatented mining claims. The privately owned interests within the KNF total about 1,809 acres. Of this total, ASARCO owns both the surface and mineral estate for about 123 acres adjacent to but outside of the CMW. ASARCO does not own any surface estate inside the wilderness, but does hold title to about 1,686 acres of mineral estate. It obtained title to these lands from the United States after an extensive application and examination process required by law and regulation. Ownership was conveyed by mineral patents (instruments conveying fee interest) issued for mining claims under the 1872 Mining Law. These patented mining claims contain the ore reserves ASARCO has proposed to mine.

ASARCO may also hold other property interests in the area through unpatented mining claims that could overlie additional mineral resources. There are also mining claims that overlie the proposed mill site and part of the tailings impoundment. Unpatented mining claims are lands where primary title still rests in the United States, but the claimants may hold a real property interest that could entitle them to such things as:

- removal of valuable mineral deposits;
- siting of mill and waste facilities; and
- being granted title (patent) to the claims.

In order to determine ASARCO's actual property rights and interest, these claims would have to be subjected to an extensive technical and legal examination to determine if they were valid in all respects under the mining law.

The following scenarios describe how the No-action Alternative might be implemented:

- If both KNF and DSL determined that ASARCO could not comply with all applicable laws and regulations, DSL could deny ASARCO's permit application and KNF could refuse to approve the plan of operations. This would likely result in ASARCO proceeding with litigation to determine whether or not they could comply with the environmental laws and regulations. If the courts agreed with the Agencies, then ASARCO would be prohibited from developing the mine as proposed, but it would not preclude ASARCO or a new applicant from submitting a new plan of operations/permit application. It would then be required to undergo a new environmental impact evaluation. If the courts agreed with ASARCO, then the Agencies could be required to approve the plan of operations with whatever court stipulations were mandated and the impacts would be similar to those described in Chapter 4 for the action alternatives.

- If the Forest Service refused to approve the plan of operations, a court might conclude that this constituted a regulatory taking of ASARCO's property interests without just compensation. If so, the court could order the United States to reimburse ASARCO for the value of the property taken. The patented and unpatented lands may be worth hundreds of millions of dollars for which Congress would likely have to appropriate funds.

  A court might also conclude that the Forest Service had violated the Administrative Procedures Act (5 U.S.C. 553) for taking an action unsupported by law, and order it to comply with the law.

- The Forest Service does not have authority to acquire the ASARCO property through a condemnation action. However, Congress could concurrently give the Forest Service authority through special legislation to condemn the property, forcing sale of it to the United States, and appropriate money to pay for the purchase. Depending upon the authority used, any lands purchased by the U.S. usually have acquired status, meaning that the mineral estate is subject to leasing, not to mineral location.

- Another scenario is a willing buyer/willing seller approach. If ASARCO were willing to sell, and the United States willing and able to purchase the property, a "buyout" could be implemented. Subject to some restrictions, the Forest Service has the authority to purchase lands that meet Forest Plan and national objectives. However, Congress currently has not appropriated money for the Forest Service to purchase these lands. To assist in evaluating the options to implement the No-action Alternative, the Agencies have approached ASARCO to see if it would willingly sell the property to the United States, and at what price. ASARCO has not yet replied.

  Under this scenario, as provided in the 1964 Wilderness Act, Congress would have to specifically authorize the acquisition of the wilderness portion of the lands, as well as appropriate the necessary money to purchase all of the lands.

  Depending on the authority used, any lands purchased by the United States usually have acquired status, which means that the mineral estate is subject to leasing, not to mineral location. However, the lands could be withdrawn from mineral location.

Regardless of the actual details of implementation of the No-action Alternative, the result would be the lack of mine development. Chapter 4 outlines the likely effects of the lack of mine development and assumes minerals have been withdrawn from future entry. If minerals were not withdrawn from future entry, mining could again be proposed at some future date. The effects would be evaluated at the time such a proposal was submitted.

Alternative II -- ASARCO Project Description (Proposal)

Alternative II is ASARCO's project as proposed in the application and plan of operations submitted to the Department of State Lands (DSL) and Kootenai National Forest (KNF). Important highlights of ASARCO's proposed exploration, operating, and reclamation plans are described below. For specific details, see ASARCO's exploration and operating permit applications.

ASARCO proposes to construct a 10,000-ton-per-day mine and mill complex to extract copper and silver ore from a mineral deposit underlying a portion of the CMW, about 13 miles northeast of Noxon, in Sanders County, Montana. (See **figures 1-1 and 2-4**.) ASARCO acquired title to the minerals by using the minerals patent process of the 1872 Mining Law. The project is similar in scope and operation to ASARCO's inactive Troy Mine in Lincoln County, Montana. ASARCO anticipates a 1-year period for constructing the exploration adit in addition to a 3-year period for mine construction and development with limited ore production (see **Figure 2-5**). Full production would begin after that and

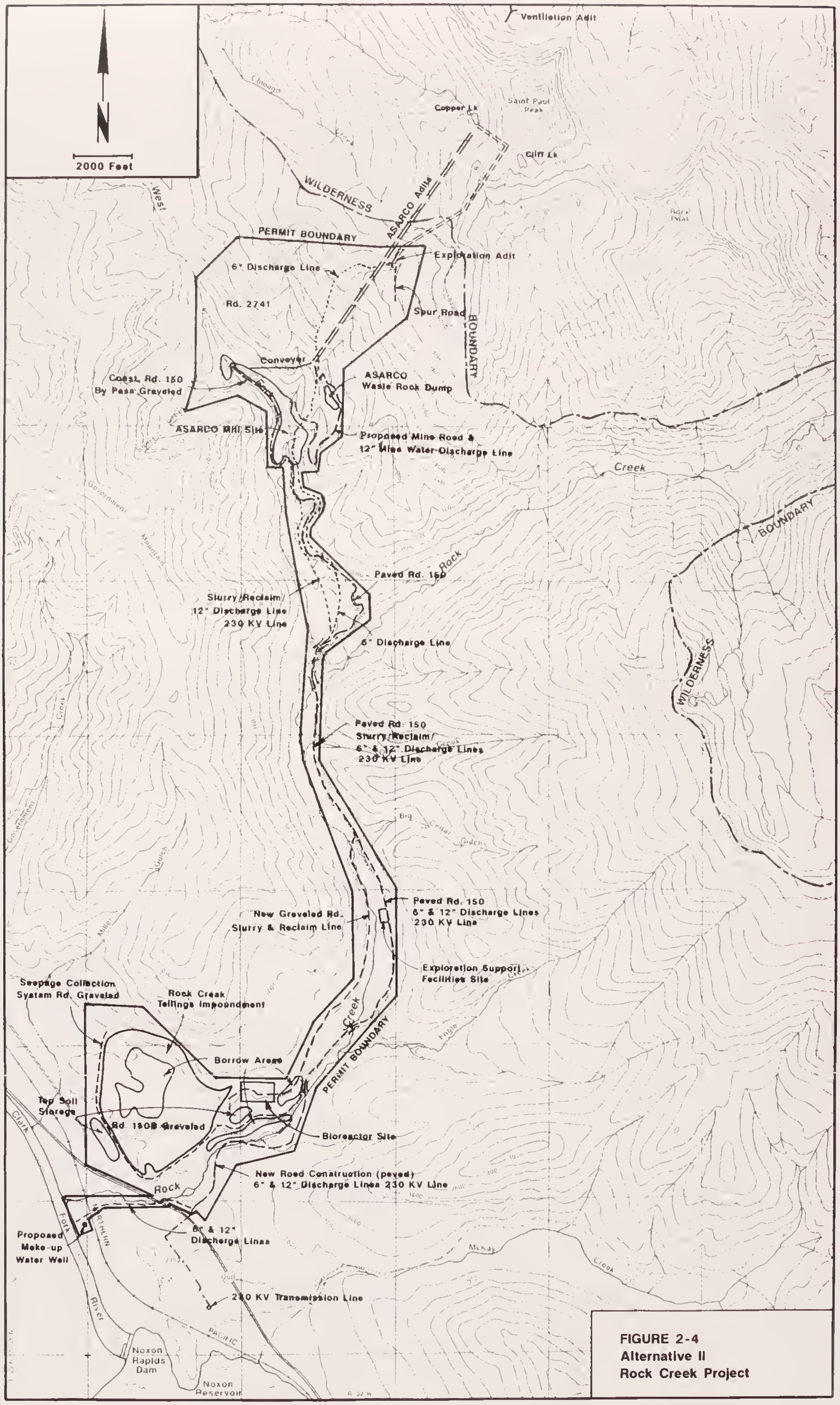
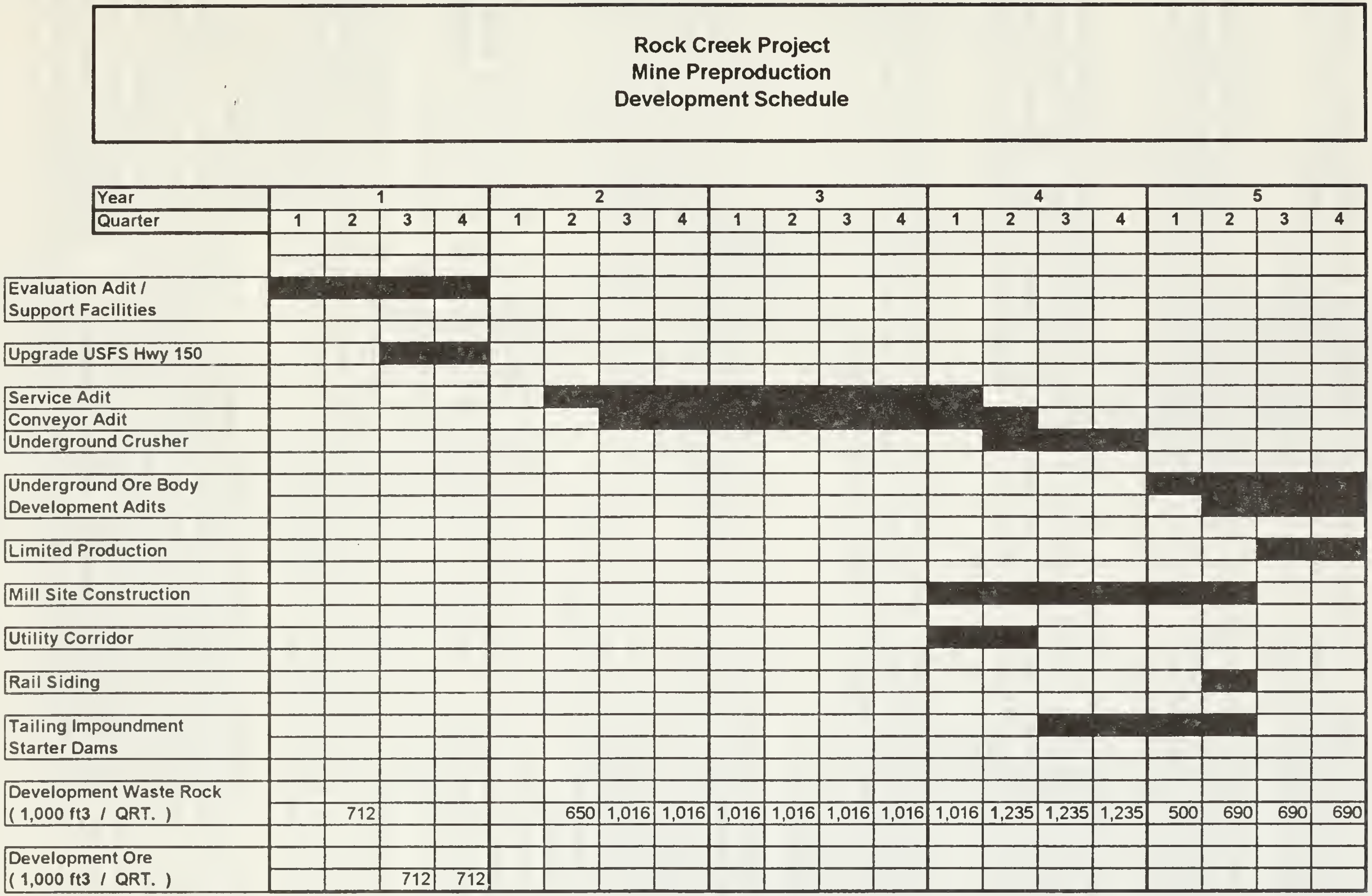


FIGURE 2-4
Alternative II
Rock Creek Project



HWY 200 Source: ASARCO, Incorporated 1995.

FIGURE 2-5
Mine Preproduction Development Schedule
Rock Creek Project

is estimated to last for 30 years. The full production life would depend upon metal prices, engineering, and other factors that determine financial viability. Postmining reclamation is estimated to last 2 years (after the tailings impoundment surface dried enough for reclamation activities).

Ore would be initially processed in an underground crusher. The above-ground ore-processing complex would further crush and grind ore to liberate metal-bearing sulfides. Sulfides would then be removed by flotation, dewatered, and trucked to a proposed rail load-out at Hereford (also known as Noxon rail siding), and then shipped to an off-site smelter.

The entire mill complex, including surface conveyor, office building, shop, sewage treatment plant and warehouse, would be located in the West Fork Rock Creek drainage. Tailings from ore processing would be deposited in a tailings impoundment north of Montana Highway 200 near its junction with Rock Creek Road (Forest Development Road No. 150). Additional project facilities would include an access road, utility corridors, and rail siding.

The proposed permit boundary would encompass 2,422 acres, of which 583 acres are proposed to be disturbed and 1,839 would remain undisturbed. Land encompassed by the permit boundary is 35 percent privately held and 65 percent NFS lands (see **Figure 2-6**).

Exploration Adit

The proposed exploration adit (**see figures 2-4 and 2-7**) would be driven prior to other work on the Rock Creek Project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as an additional ventilation (exhaust) opening and as a secondary escapeway, when the two adits met. Conventional mining methods would be employed for the 1-year adit construction period. Access would be by existing roads and an estimated 8.3 acres would be disturbed. More details on the exploration adit can be found in the Rock Creek Exploration Adit License Application (ASARCO, Incorporated 1992).

The portal of the adit would be located at about 5,755 feet elevation . The adit would be 18 feet high by 18 feet wide with an estimated length of 6,592 feet at a decline of 10 percent until the mineralized zone was intersected. Forty-foot cross cuts would be driven from the adit every 500 feet to provide turnouts for vehicle passing, sump construction, and space for pump installations.

About 59,000 tons of waste rock and 119,000 tons of ore would be excavated from the proposed adit. Unmineralized or barren waste rock would be end-dumped near the portal to form a flat-topped pile sloping downhill to its angle of repose. Mineralized material would be placed in a stockpile near the portal for later processing when the mill was in operation.

Additional support facilities are proposed to be constructed for the exploration adit. Some of these facilities would be located on 13 acres of ASARCO property in Section 22 near the 3-mile marker of FDR No. 150. These include: an office situated in a 12-foot by 60-foot trailer or other similar structure; a changehouse/dry set up in another trailer; a garage and warehouse located in a pre-engineered steel building on a concrete slab; and a graded, graveled employee parking lot. A 500-gallon above-ground building on a concrete slab; and a graded, graveled employee parking lot. A 500-gallon above-ground gasoline storage tank in a lined containment structure would be located near the garage and warehouse.

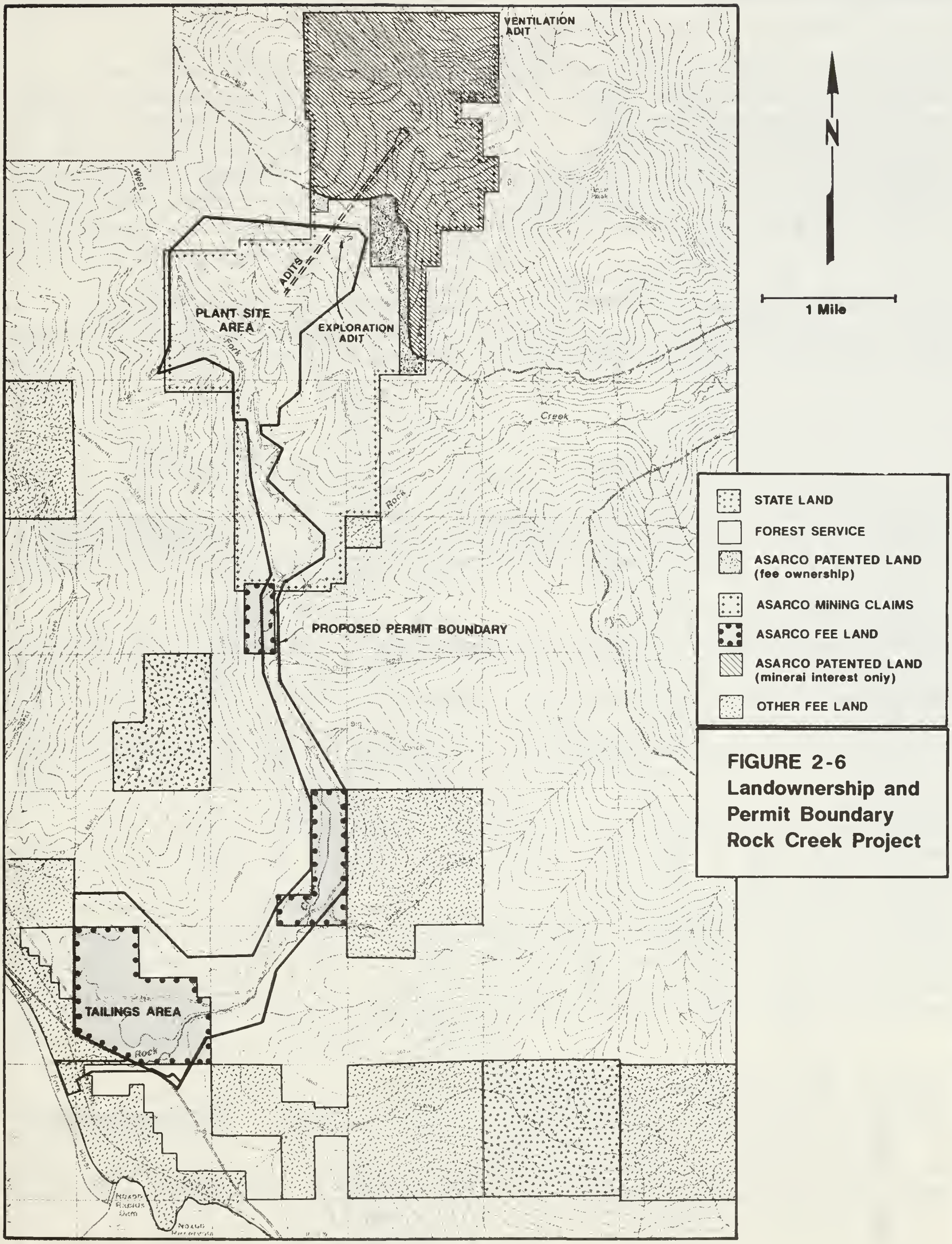
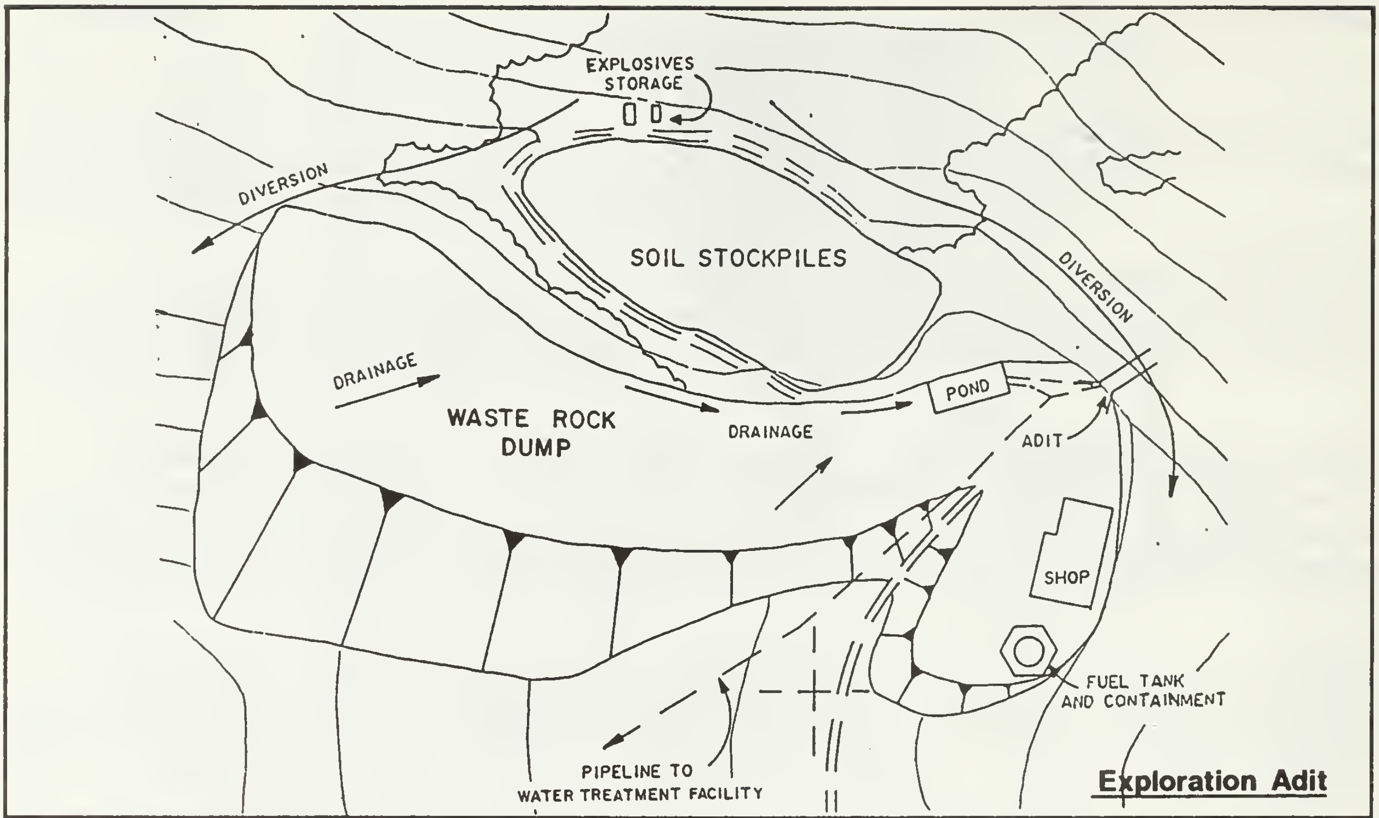
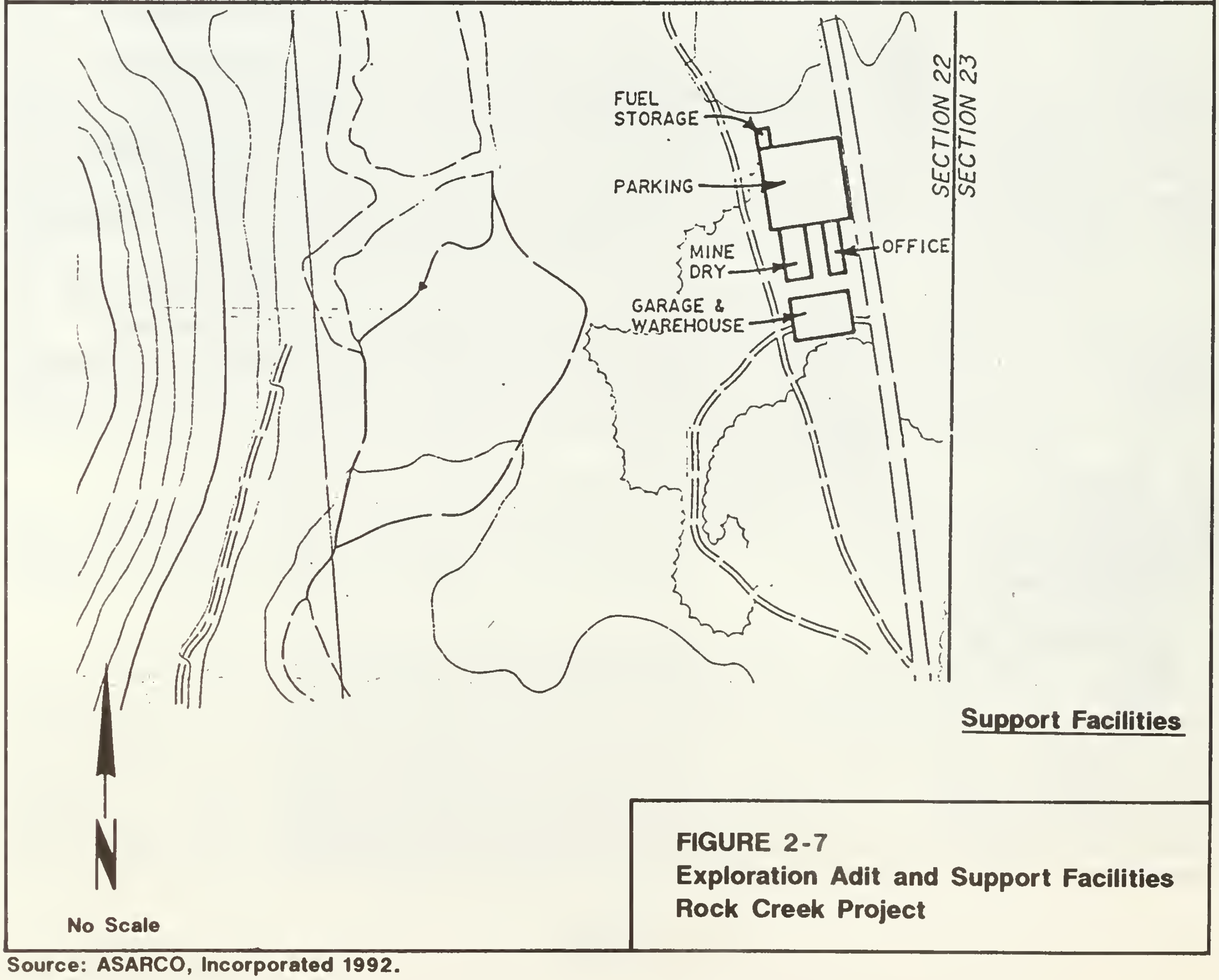


FIGURE 2-6
Landownership and Permit Boundary
Rock Creek Project



Exploration Adit



Support Facilities

FIGURE 2-7
Exploration Adit and Support Facilities
Rock Creek Project

Source: ASARCO, Incorporated 1992.

A few additional facilities would be located at the adit site. A 40-foot by 80-foot temporary steel building on a concrete slab would be constructed on top of the initial waste material removed from the adit. This building would provide warehouse space, indoor work space, a lunchroom, and lavatories. Two 500-kilowatt (kW) diesel generators would be located in a lean-to attached to this building to provide power during adit construction. A 20,000-gallon above-ground diesel storage tank in a 30,000-gallon lined containment structure would be located near the shop building at the adit site. Upon completion of the exploration adit, all facilities would be either removed from the permit area or moved to the mill site for use during mining.

Additional facilities would be constructed to treat adit discharge and sewage (see Water Use and Management). Road construction associated with exploration is covered under Transportation. Power supply is covered under Utilities. Revegetation and soils salvage and handling are covered under Reclamation.

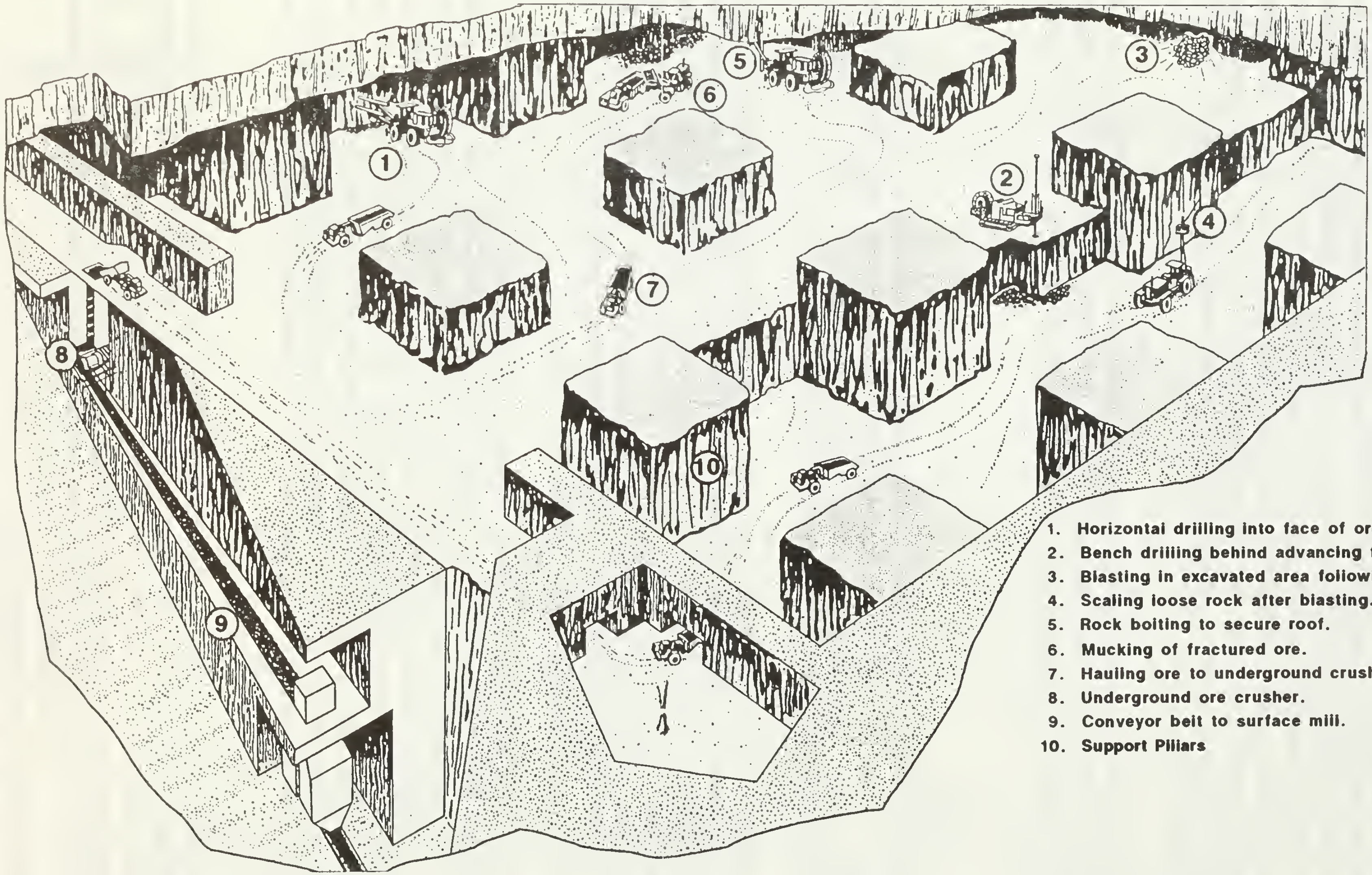
Mine Plan

ASARCO would develop an underground mine producing 10,000 tons of ore per day, or 3.5 million tons per year. Current ore reserves are approximately 144 million tons with 1.65 oz./ton of silver, and 0.68 percent copper. Ore extraction is expected to be 75 percent with a milling efficiency of 85 percent, giving the mine an anticipated production life of 30 years.

Mine development would include driving two parallel adits directly northeast of the mill site. Adit portals are proposed outside the wilderness boundary (see **Figure 2-4**). The north adit would be used as a conveyor adit and the south as a service adit for mine access. A level working area at the portal would be constructed by cutting into the hill to create a vertical face for adit construction. Adit size is dictated by ventilation requirements and dimensions of mining equipment. Each adit would be 25 feet wide by 20 feet high. The two parallel adits would be driven concurrently at a grade of +12.7 percent about 9,000 feet to the site for the underground primary crusher.

Electric ventilation fans would initially use the conveyor adit for intake and the service adit for exhaust. The exploration adit would be used for primary exhaust removal when the underground workings reached it. In the future, if the Mine Safety and Health Administration (MSHA) required additional ventilation, it would be necessary to drive an adit to the surface in the wilderness to provide an additional air intake and a secondary escapeway from the mine. The ventilation adit would be driven from the underground workings; there would be no need for the creation of a waste rock dump at the adit portal in the wilderness. Fans would be located no closer than 200 feet underground from the wilderness adit opening. ASARCO would contact the Forest Service prior to construction for approval of siting and construction methods.

The room-and-pillar system of mining is used for most flat-lying or nearly flat-lying ore deposits where the ground is hard and firm, and where artificial means of support would be too costly. Room-and-pillar is one of four common types of open stope (underground excavation) methods. In room-and-pillar mining, some ore is left unmined to give support to the mine roof (see **Figure 2-8**). The slot-pillar system is similar to room-and-pillar. Rather than a regular pattern of rooms and square pillars,



1. Horizontal drilling into face of ore body.
2. Bench drilling behind advancing face.
3. Blasting in excavated area following drilling.
4. Scaling loose rock after blasting.
5. Rock bolting to secure roof.
6. Mucking of fractured ore.
7. Hauling ore to underground crusher.
8. Underground ore crusher.
9. Conveyor belt to surface mill.
10. Support Pillars

FIGURE 2-8
Room-and-Pillar Method
Rock Creek Project

Source: ASARCO, Incorporated.

a slot pillar is longer in one direction, creating a system of rectangular pillars and rooms (see **Figure 2-9**). This design is used when more ground support is needed. Generally, a regular pattern of pillars is more efficient than an irregular one, and the size and spacing of support pillars varies depending on local ground conditions (Earll 1976). ASARCO proposes to use a combination of room-and-pillar and slot-pillar designs[1]. The majority of the mine layout would use a regular pattern of rooms and pillars. A design layout similar to ASARCO's Troy Mine is proposed. The determination of when to use a regular pattern versus a slot pillar approach would be made after examining local ground conditions and rock mechanics data.

In order to protect against surface subsidence, ASARCO proposes to leave a minimum 100 feet of overburden between any working area and the ground surface. This limit would be modified based on site-specific information gathered as a result of the ongoing mining operation.

In the Copper Lake Fault area where ore thicknesses exceed 100 feet, ASARCO proposes to leave a large barrier pillar between the fault zone and the active mine area. The function of the barrier pillar would be to provide stability in this area of large ore horizon thickness and potential poor ground conditions. The dimensions and location of the barrier pillar(s) would be determined after assessing local ground conditions.

In areas where the proposed ore extraction thickness exceeded the capacity of designed pillars, ASARCO proposes to use a horizontal pillar to facilitate extraction over the entire ore height. A horizontal pillar is a section of unmined material left in place between two rooms stacked one on top of another (see **Figure 2-10**). Using a design from the Troy Mine, ASARCO expects to use this approach when ore thicknesses exceed 75 feet[2]. Although ore recovery is reduced to 52 percent from 75 percent using this design, it would allow for ore extraction over the entire ore column.

Conventional mining methods of drilling, blasting, rock bolting, and mucking would be used underground. Broken ore would be processed by an underground crusher and then transported to the surface via conveyor belt for further processing. A surface conveyor belt would transport ore from the adit portal to the mill. During project construction, an estimated 600,000 tons of waste rock would be produced. A portion would be used as fill for the mill site and as construction material for the tailings impoundment, while the remainder would be placed in a hillside waste rock dump (see **Figure 2-11**).

A maximum of 2,500 cubic yards of ore mined during the construction period would be stockpiled at the mill site for treatment following construction of mill facilities. Waste rock generated underground during the production period would be stored in mined-out areas. Residual waste from ore processing would be disposed above-ground in a tailings impoundment.

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[1] The pillars would be 45 feet square and drives and cross-cuts 45 feet wide. Ore recovery is projected at 75 percent. As ore thickness increased and/or overburden decreased more ground support may be necessary. Again, using a design from the Troy Mine, ASARCO proposes to use a slot-pillar approach. The pillars would be 30 feet wide while the drives would be 50 feet wide. The overall length of the slot pillar would vary but could be on the order of several hundred feet long. Ore recovered using this approach is reduced (10 percent at Troy Mine), however ground support is improved.

[2] Vertical pillars would be 30 feet wide, rooms 50 feet wide, and the horizontal pillar 40 feet thick. In this manner a 200-foot thick ore horizon could be mined with two 80-foot-tall rooms with the intervening 40-foot horizontal pillar.

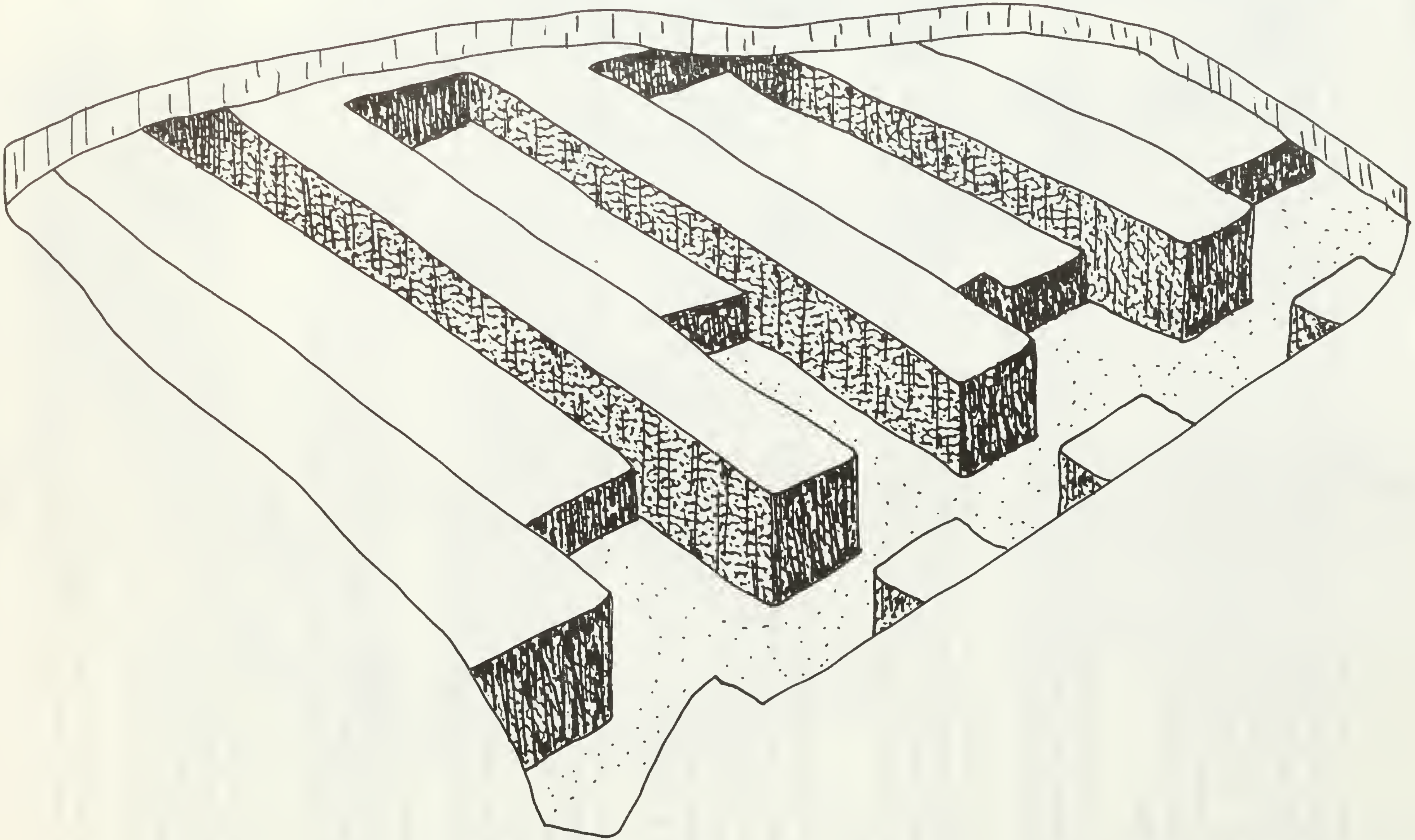

FIGURE 2-9
Slot Pillar Method
Rock Creek Project

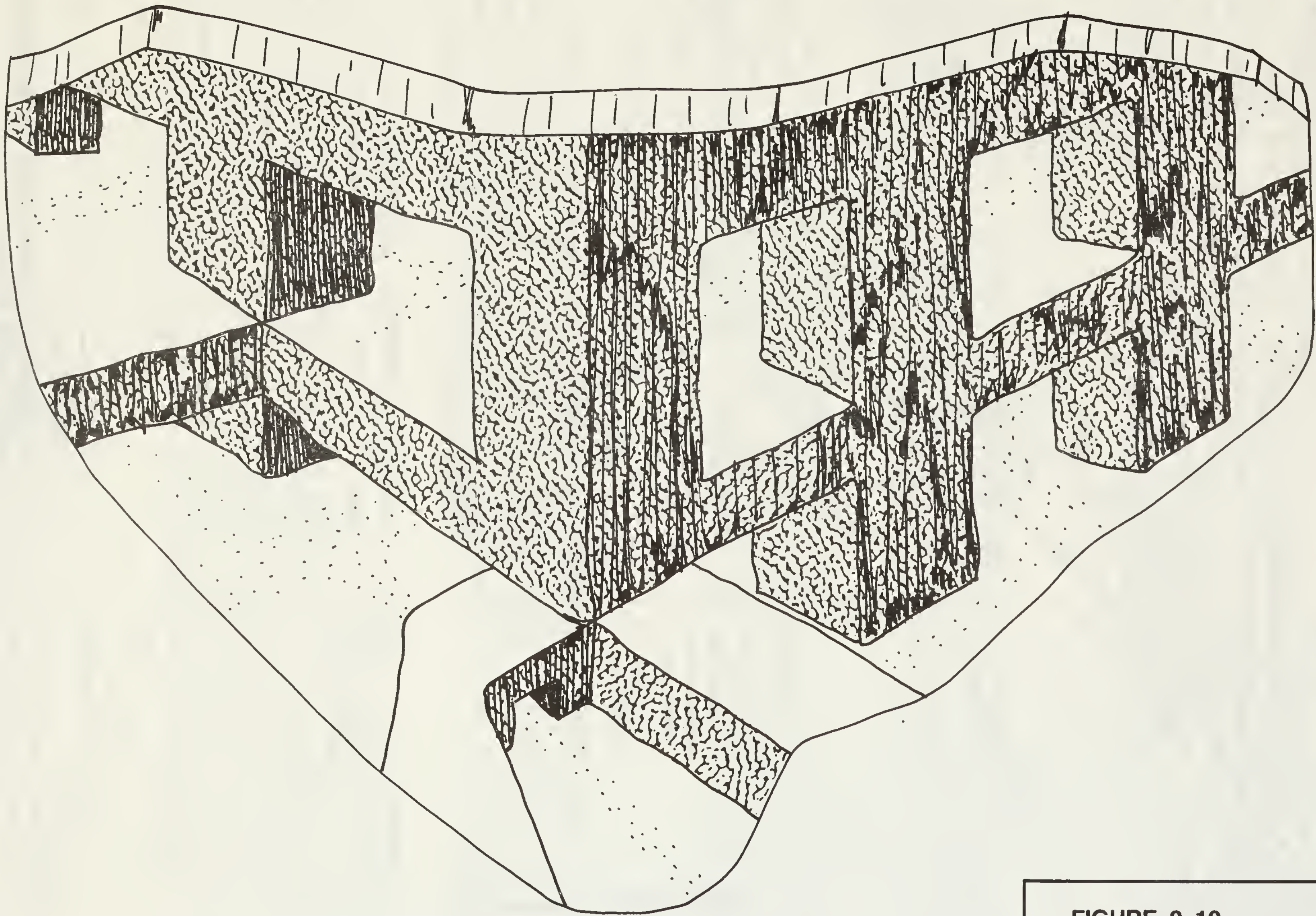

FIGURE 2-10
Thick Ore Zone
Room-and-Pillar Method
Rock Creek Project

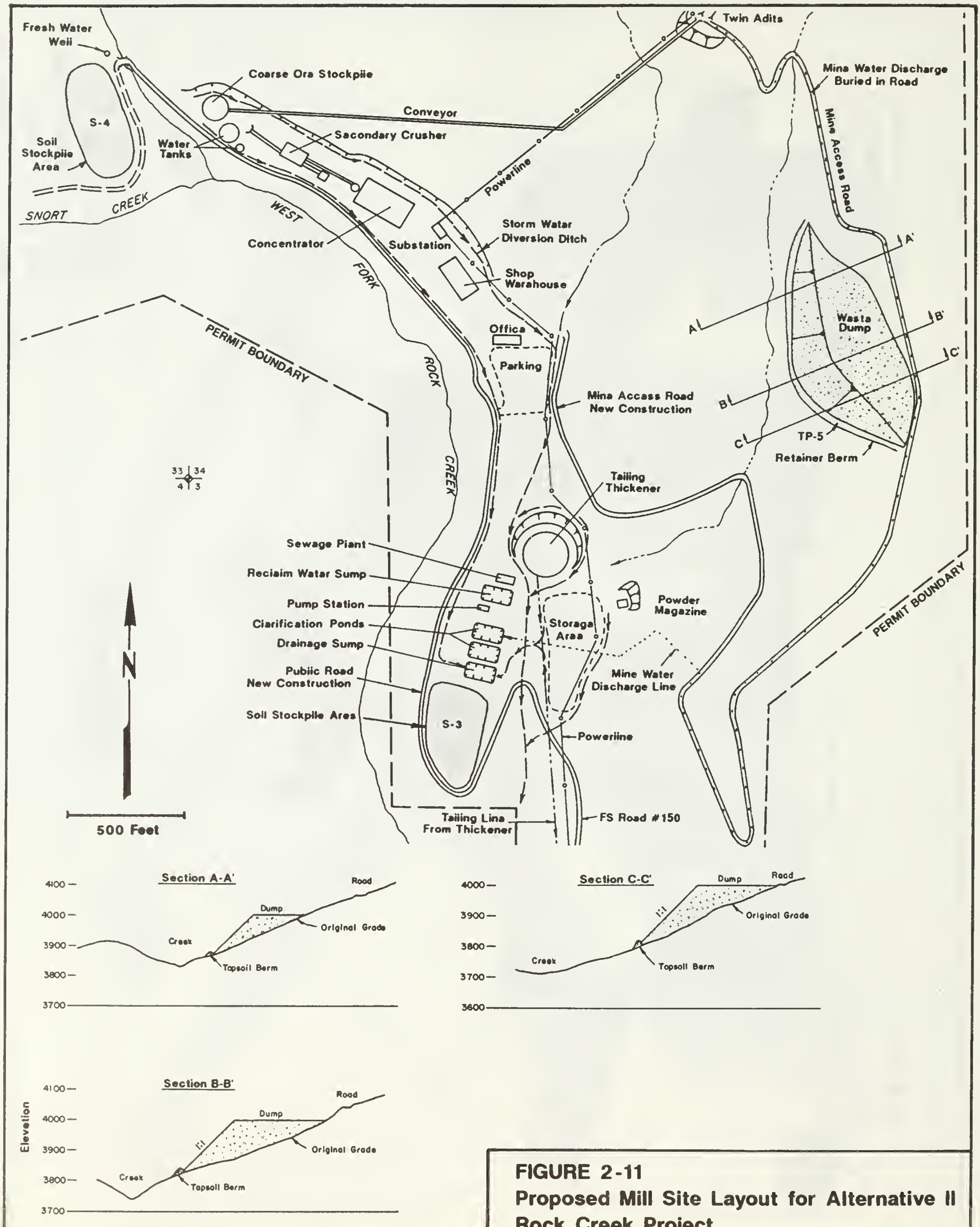

FIGURE 2-11
Proposed Mill Site Layout for Alternative II Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

Seasonal storage of mine water within underground mine workings is proposed to regulate outflow through the water treatment system. By year 27, a 207.7-million-gallon reservoir would be established in worked out portions of the mine to handle maximum water storage requirements. This would equate to a maximum storage capacity of about 64 acres with water 10 feet deep. The area and volume required for storage would be increased throughout the mine life on an as-needed basis. The storage areas would be mined using conventional methods except that barrier pillars would be left in place along either side of the storage area.

Surface Disturbance

Surface disturbance would result from construction and maintenance of the tailings impoundment and associated components, transportation corridor, mill facilities, water treatment facility, mine, and exploration adit (see **Table 2-1**). A total of about 583 acres would be disturbed within the permit area. The Forest Plan would be amended to change the management area allocation on 362 acres to make it consistent with the intended use.

Less than 3,000 square feet of surface would be affected by the ventilation opening in the wilderness area. Since this opening would be driven from inside the mine to the surface, very little (no specific quantity provided by ASARCO) waste rock would be deposited on the surface at the opening; the disturbed area would be limited to the opening itself. The opening would be covered by a tamper-resistant grate.

Ore Processing and Shipment

The ore-processing facility would consist of an underground primary crusher, an above-ground secondary crushing plant, concentrator, tailings thickener, drainage sumps, pumps and slurry and water pipelines. An office building, changing rooms and showers, and shop warehouse also would be located at the mill site. The ore-processing plant would operate 7 days per week, about 354 days per year for a total processing capacity of 3.5 million tons/year.

The milling process involves five major steps; crushing, grinding, flotation, concentrate dewatering, and tailings storage. **Figure 2-12** illustrates the steps used in ore processing. Crushing, grinding, and flotation would produce tailings and a single concentrate containing both copper and silver. Chemical reagents[3] would be added during the flotation process to separate the ore concentrate from the tailings (see **Appendix F**). Concentrates leaving the flotation process would be pumped to a concentrate thickener where a portion of the water would be removed for reuse in the mill. After further dewatering, concentrates would be deposited in a bin from which they would be loaded into haul trucks for transport to the Hereford rail load-out (see **Figure 2-4**). Some reagents would be disposed with the tailings and some would remain in the ore concentrate.

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[3] A variety of reagents would be used in ore processing. These would include Xanthate, Yarmor-F Pine Oil, Dow 250, Superfloc S-5595, and Orzana A. **Appendix F** lists the reagents, physical characteristics and toxicity of each reagent, the addition points in ore processing, and the estimated annual consumption.

TABLE 2-1.
Surface Disturbance Acreage (net acres impacted)

Disturbance Type	Alt II	Alt III	Alt IV
Tailings impoundment & associated components	**388.9**	**404.1**	**404.1**
Dam faces and impoundment surface	324.0	324.0	324.0
Borrow areas 2 and 3	27.2	27.2	27.2
Roads	6.6	6.8	6.8
Soil stockpiles sites	21.7	36.7	36.7
Water control structures	9.2	9.2	9.2
Pump station	0.2	0.2	0.2
Transportation corridor	**96.1**	**90.8**	**70.4**
Access road	36.2	43.8	36.0
Tailings line corridor	13.4	0.1	2.4
Powerline	44.3	37.9	29.8
Emergency impoundments	2.0	2.0	2.0
Fresh water well	0.2	0.2	0.2
Mill facilities	**40.0**	**55.6**	**47.8**
Fenced area	40.0	40.0	47.0
New public road	1.3	6.0	0
Fresh water well	0.1	0.1	0.1
Water control structures	1.5	1.5	.7
Soil stockpile sites	6.0	6.0	**
Water treatment facility	**10.0**	**10.0**	**10.0**
Mine	**29.9**	**38.0**	**0.1**
Access road	15.2	16.4	**
Waste rock dump	40.0	17.0	0
Portal area	1.5	1.2	**
Powerline corridor	0.1	0.8	**
Conveyor corridor	1.2	1.2	**
Air intake adit	0.1	0.02	0.02
Water control structures	0.1	0.1	0.1
Soil stockpile sites	1.5	1.5	**
Exploration Adit	**9.6**	**9.6**	**9.6**
Mine entry patio and waste rock dump	8.3	8.3	8.3
Support facilities	1.3	1.3	1.3
Total Acres Disturbed	**583.4**	**608.1**	**542.0**

** Covered under Facilities (part of "fenced area")

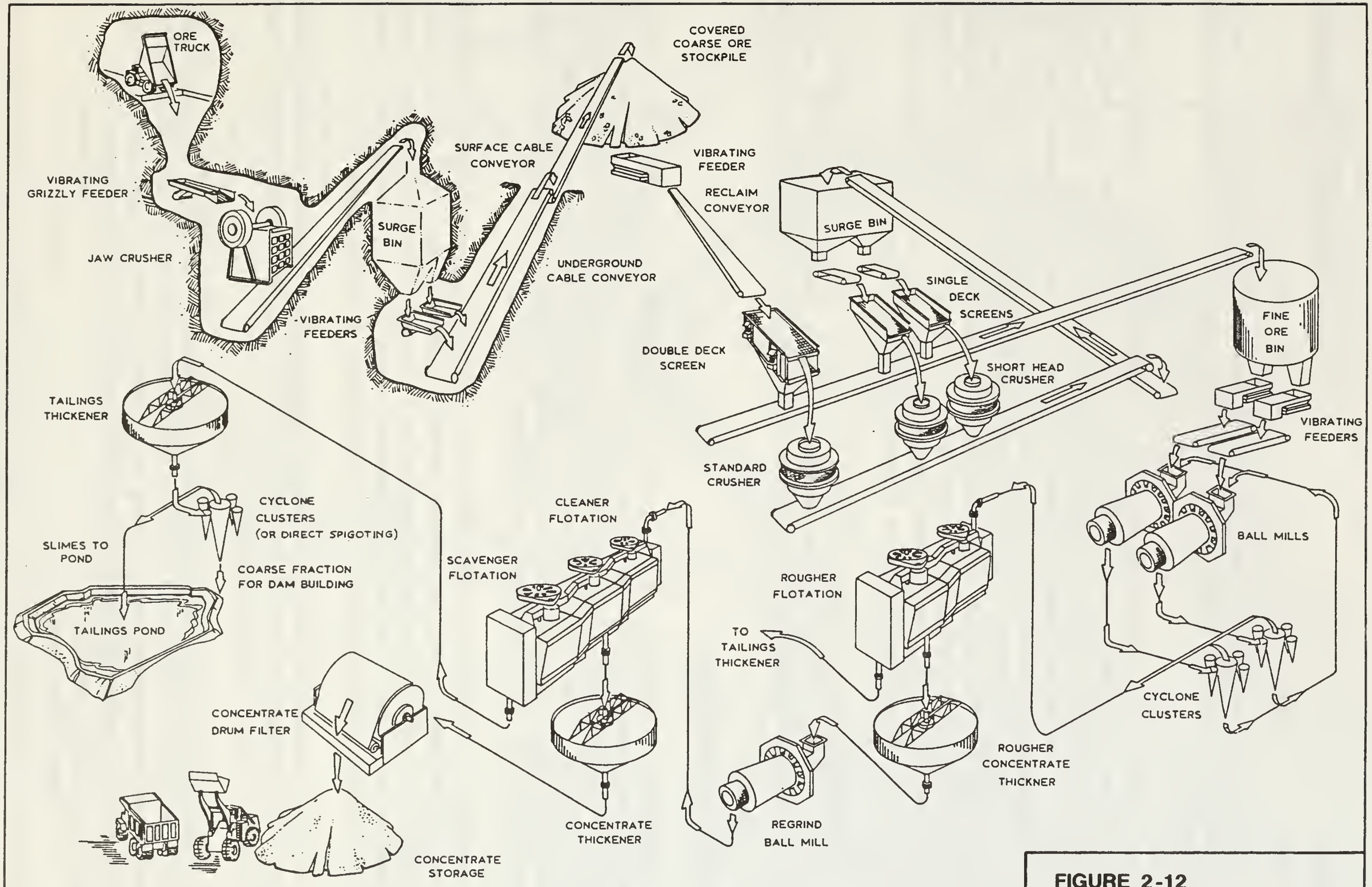


FIGURE 2-12
Ore-Processing Flowsheet
Rock Creek Project

Sources: ASARCO, Incororated 1987-1994.

Tailings from the milling process would go to a 250-foot diameter tailings thickener. Water in excess of that needed to move the tailings to the impoundment in twin slurry pipelines would be removed for reuse in the mill.

About 51,000 tons of concentrate per year (about 1.4 percent of mined ore) would be trucked 13 miles to the Hereford railroad load-out via FDR No. 150 and Montana Highway 200. Concentrate would be hauled 8 a.m. to midnight, 7 days a week. From the junction of FDR No. 150, the rail siding is about 6 miles northwest at Hereford via Montana Highway 200, then 0.25 mile over a graveled county road. The existing rail siding location runs east and west perpendicular to the county road. The track is in good condition. No initial capital investment of track was anticipated by ASARCO. However, Montana Rail Link has determined that about $144,000 of initial capital investment in rail track would be required. ASARCO proposes to construct a concentrate hopper/conveyor at the west end of the Hereford siding. The facility would include a drive-over ramp with a hopper located in the center. The end-dump trailer would dump into the hopper, which would have a capacity of about 40,000 pounds.

The concentrate would be loaded immediately into a rail car. Rail cars would be loaded six to eight times every 24 hours. ASARCO intends to negotiate a freight agreement calling for the removal of loaded rail cars three times per week. The railroad would determine actual days for loaded rail car removal.

Tailings Impoundment

Impoundment Construction. The proposed tailings impoundment location is about 3 miles southeast of Noxon, northeast of Montana Highway 200, near the confluence of Rock Creek and the Clark Fork River (see **Figure 2-13**). The majority of the impoundment would be located on ASARCO's private land (255 acres) in Section 28, T26N, R32W, bordering NFS lands to the east and north. The impoundment area ranges in elevation from 2,360 to 2,700 feet. The impoundment eventually would fill to the point that about 69 acres of adjacent NFS lands would be covered.

The proposed tailings impoundment would be constructed using the upstream method (see **Figure 2-3**). It would be designed to contain the estimated 100 million tons of tailings to be produced over the 30-year mine life. Details of the design are presented in *Preliminary Design Study Tailings Disposal System* (Dames & Moore 1993). The dam is designed to withstand a 7.0 magnitude earthquake occurring on the Bull Lake Fault. Engineering aspects of the design are discussed in **Appendix E.**

The tailings impoundment design is preliminary and would be modified as additional information was obtained. The Agencies would provide a technical review of the final design and possible future revisions to ensure conformity with design goals.

The impoundment would require construction of a perimeter embankment on the downhill sides of the facility. Initial starter dams would be constructed with nearby borrow materials and waste rock. These dams would provide tailings storage during initial stages of operation. The perimeter tailings embankment would be constructed, shaped, and maintained using earth-moving equipment.

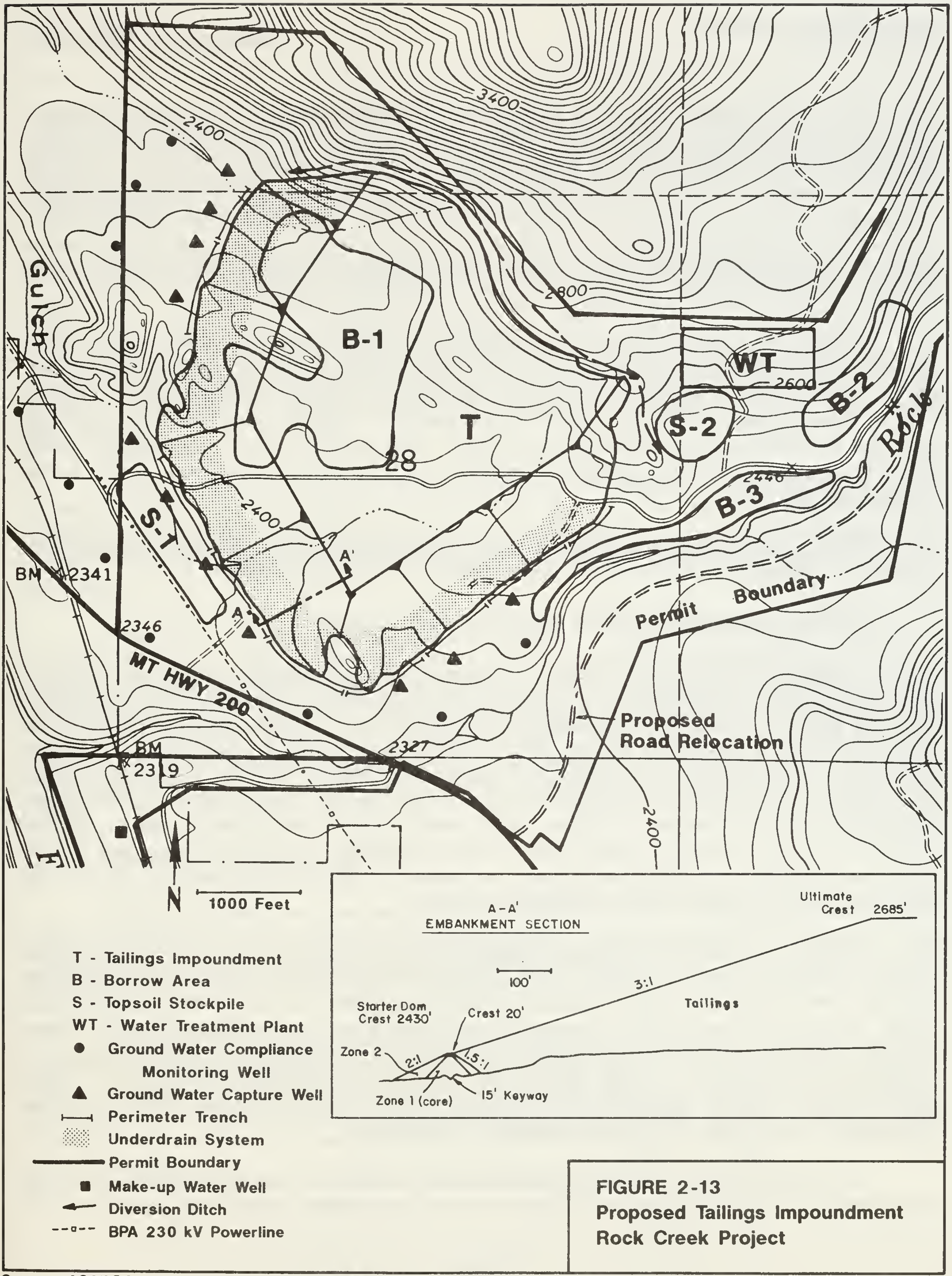


FIGURE 2-13
Proposed Tailings Impoundment
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994, and 1995.

Due to topographical features of the area, two initial impoundments constructed from borrow material would be operated, referred to as "primary" and "secondary" areas. Embankments would be incrementally raised with sand tailings to provide additional storage capacity, using the conventional "upstream" method of construction. With this method, the crest of the expanding embankment section is progressively shifted upstream of the original starter dam crest. As embankments increase in height, the two impoundment areas would join, forming a single storage facility ultimately covering 324 acres. In order to provide sufficient capacity for mine life, the embankment would be raised about 325 feet, as measured from the toe of the embankment, to an ultimate elevation of 2,685 feet.

Tailings Disposal. Tailings slurry from the thickener would be transported above-ground via twin 10-inch, urethane-lined, steel pipelines about 30,700 feet (5.8 miles) to the impoundment for disposal. Excess water from the tailings impoundment would be pumped a similar distance back to the mill for reuse as make-up water via a buried 12-inch steel reclaim line. All lines would be encased in a larger steel pipe at creek crossings to guard against spillage. Small emergency dump impoundments (ponds) would be provided in critical areas along the pipelines, such as prior to stream crossings, to contain potential spillage.

The proposed method of material segregation (separating the sand fraction from the slimes) and placement (depositing the materials in the impoundment) is described in **Appendix E.**

Tailings Impoundment Seepage and Storm Water Control

Embankment Drainage. For stability purposes, it would be necessary to control the seepage of water from within the impoundment outward through the embankment. The general goal is to intercept the water before it seeps from the downstream face of the dam. For this reason, embankments are designed to provide preferential seepage paths to direct the outwardly flowing water into drainage collection systems from which it is pumped back into the impoundment. This would involve placing the sand fraction of the tailings (free-draining material) along the base and upstream face of the starter dam. These drains would be connected to a series of pipe drains to route the intercepted drainage to collection stations from which it would be pumped back into the impoundment. These drains, combined with the sandy zone created by the 200-foot-wide beach, are intended to direct outward seepage to the drainage systems and prevent it from exiting on the face of the dam.

Tailings Impoundment Seepage. Seepage from the impoundment to underlying ground water would be contained by use of a seepage collection system that would include impoundment underdrains, perimeter trench drains, and ground water capture wells (see **Figure 2-13** and ASARCO, Incorporated 1995). Water from the underdrains and perimeter trench drains would enter a perimeter collection system adjacent to the main embankment and would be returned to the impoundment. A secondary system of capture wells is proposed to intercept seepage that would pass the perimeter trench drains. A third system of ground water monitoring wells would be used to monitor seepage collection system performance and potential exceedence of established trigger levels.

The perimeter trench drain system would penetrate to bedrock in areas where bedrock was within approximately 20 feet of the surface. Design details for the perimeter trench drain system would be developed as part of subsequent geologic and geotechnical investigations associated with the detailed design of the impoundment and would be modified based on depths to bedrock around the impoundment perimeter. Where possible, the perimeter trench drain extending to bedrock would form a cutoff barrier for ground water migration. Where the trench drain could not extend to bedrock, seepage would bypass the trench drains and migrate toward the ground water capture wells.

The system of capture wells downgradient of the perimeter trench drain system would intercept ground water prior to leaving the permitted mixing zone, and return it to the impoundment. Capture wells would be located approximately 200 to 300 feet beyond the toe of the tailings impoundment embankment. **Figures 2-13 and 2-14** show the conceptual plan for the location of 11 pairs of ground water capture wells and ten downgradient monitoring wells. Additional geotechnical drilling to support the final design plans for the perimeter seepage collection system would determine the final design, number of wells, depth of completion, spacing, and pumping rates for each of the wells in the capture well system.

After mine closure, tailings impoundment seepage would continue and diminish with time. It is estimated that the tailings impoundment would drain for several decades before reaching a steady-state condition. Some of the water from the capture wells would be used for revegetation irrigation. The seepage collection system would continue to operate until seepage met all water quality criteria and standards.

Storm Water Control. The tailings facility has two storm water control design elements: 1) diversion structures to route storm runoff from outside of the immediate impoundment area around the tailings facility (see **Figure 2-13**), and 2) containment within the impoundment of storm water that would fall directly in the tailings facility. The diversion structures are designed to convey the calculated probable maximum flood (PMF). The impoundment could also contain the PMF resulting from direct precipitation into the impoundment area, however, due to its construction sequencing, this storage would require pond encroachment on the tailings beach until about year 3 of the structure's life (Chen-Northern 1990).

Water Use and Management

Exploration Operation Requirements. Water requirements for driving the exploration adit would average 30 gallons per minute (gpm) during the drilling cycle. Additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop.

Water for drilling would initially be hauled to the site from a makeup water well at the confluence of Rock Creek and the Clark Fork River (see **figures 2-4 and 2-13**). A lined pond, with a capacity of about 30,000 gallons, would be constructed near the exploration adit portal to collect site runoff and store the hauled water. A barrier would be erected around the pond to exclude wildlife. A diversion berm would be constructed above the portal and soil stockpile to divert natural runoff around disturbed areas (see **Figure 2-7**).

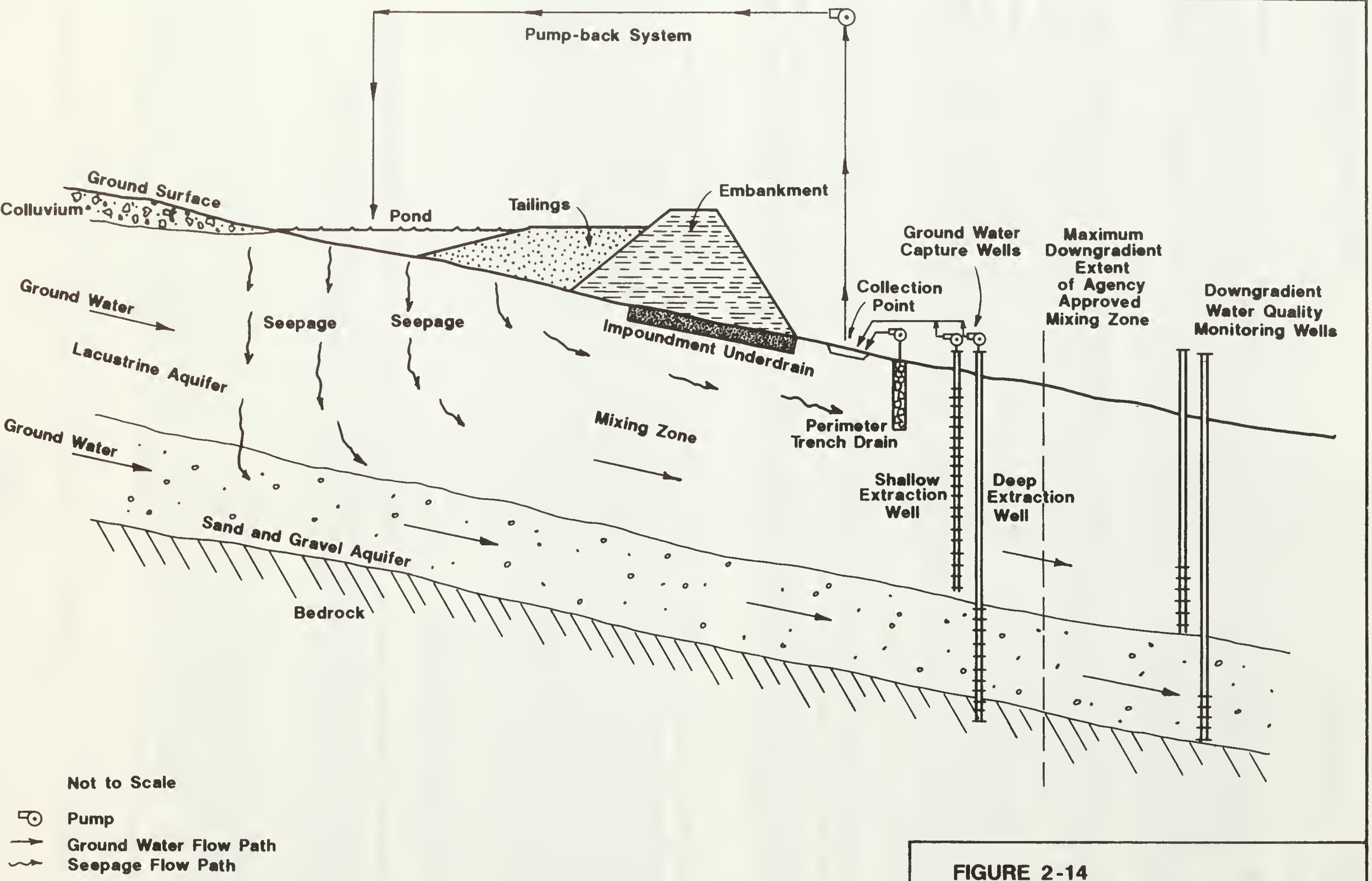


FIGURE 2-14
Conceptual Layout for Impoundment Seepage Collection System
Rock Creek Project

A pump in this pond would provide mine water during the initial adit construction phase. Water encountered in the adit during this phase would be pumped to the pond. After the adit had advanced approximately 350 feet, an 18-foot by 18-foot by 40-foot (97,000-gallon) mine sump would be excavated to function as the exploration adit water sump. A pressure filter and oil skimmer would be located at this sump to remove suspended solids and oils and grease from the water supply. Exploration adit water would undergo additional treatment per MPDES permit requirements prior to discharge. Excess filtered water would be pumped to the portal where it would enter the pipeline to a system for treatment prior to discharge to the Clark Fork River. Overflow water from the pond would also drain into this pipeline to the pilot plant. This temporary (3 to 4 years) 6-inch polyethylene pipeline would be located above-ground to the river via the biotreatment system (see **Figure 2-4**). This pipe would be removed when the mine reached the exploration adit; then the exploration adit water would be routed through the mine water drainage and collection system. See **Figure 2-15** for a schematic diagram of water handling for exploration. Characteristics of the passive biotreatment system are discussed in detail in the following section (mine operation requirements).

Potable water would be trucked to the adit site and stored in a tank in the shop until a suitable source was found in the adit. Two wells would be installed to supply the support facility. Sewage from the lavatory in the adit shop, and from lavatories in the office and the mine dry at the support facility would drain to conventional septic tanks and drainfield systems. If, according to DHES, either or both of the proposed sites or their alternate locations were not suitable for a drainfield, then a holding tank would be installed. This tank would be pumped periodically and hauled to a municipal sewage disposal facility (ASARCO, Incorporated 1992).

Mine Operation Requirements. **Figure 2-16** provides a schematic diagram of project water handling for mine operation (years 10 and 23). **Table 2-2** provides additional water balance detail. During full production, the mill would require 3,131 gpm of process water. This water may come from one or more of the following sources: mine adit water, a make-up water well, waste water from sewage treatment, mill site runoff, thickener overflow, and reclaimed water from the tailings impoundment. During mill operation, make-up water would be required to supplement water recycled from the tailings thickener. Because the amount of mine water discharge and available reclaim water from the tailings impoundment would vary seasonally, a make-up water well has been planned in the Clark Fork River alluvium capable of supplying full make-up water requirements. The location of this proposed well near the confluence of Rock Creek and the Clark Fork River is shown on **Figure 2-4**. A buried 12-inch steel pipeline would connect to the reclaim water line thus carrying water to the mill.

By year 30 of mining, up to 207.7 million gallons of mine and adit water per month potentially would require storage in an underground reservoir. This reservoir could require a 64-acre pond 10 feet deep. Excess water would be held in or released from storage depending on the available storage in the tailings impoundment pond and the available capacity of the passive biotreatment system. During the wet season, excess mine water would likely be stored underground. During the dry season, stored water would be released and directed to the water treatment system. A plan view and cross-section of the potential underground water storage area are provided in **Figure 2-17**.

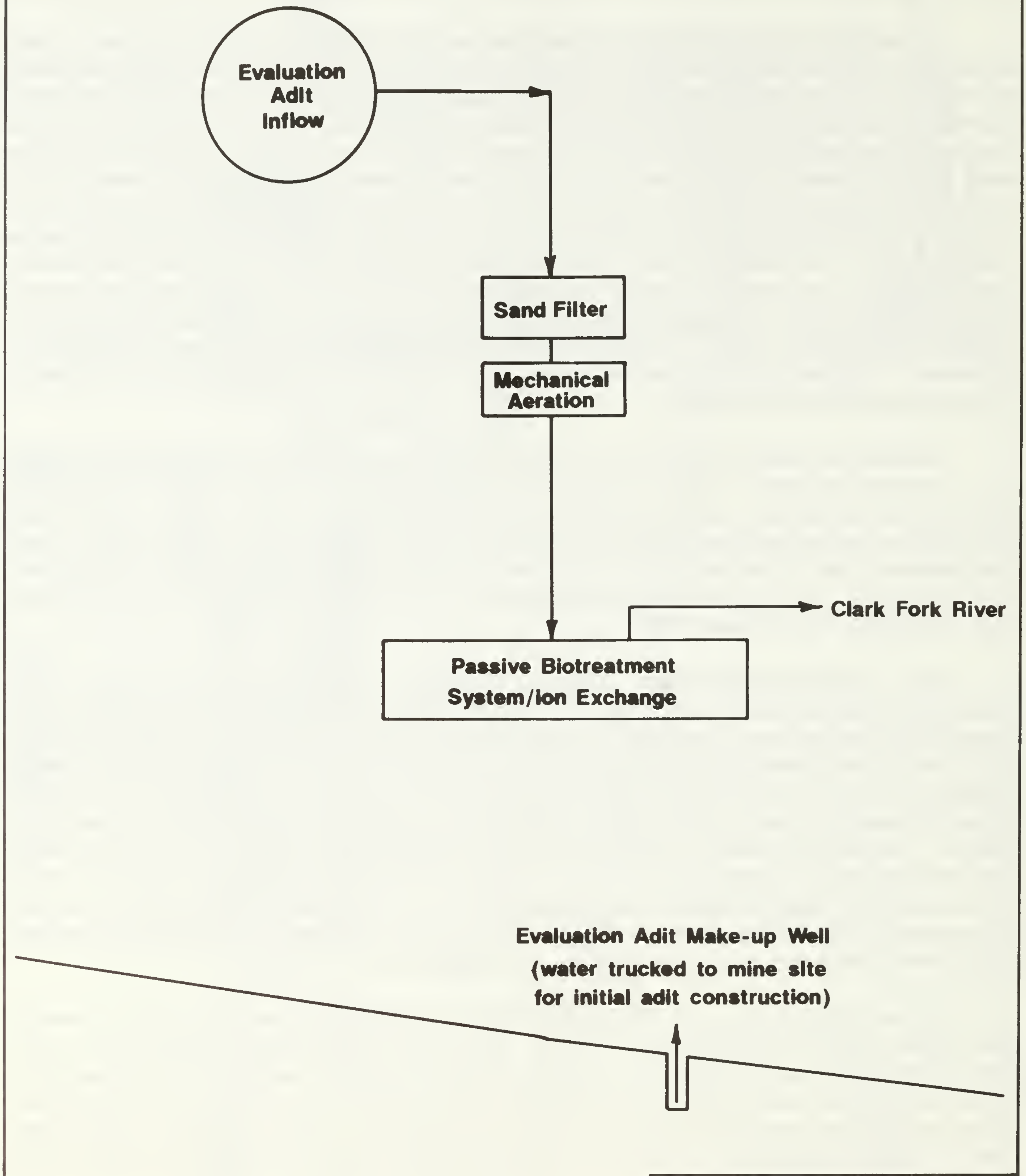
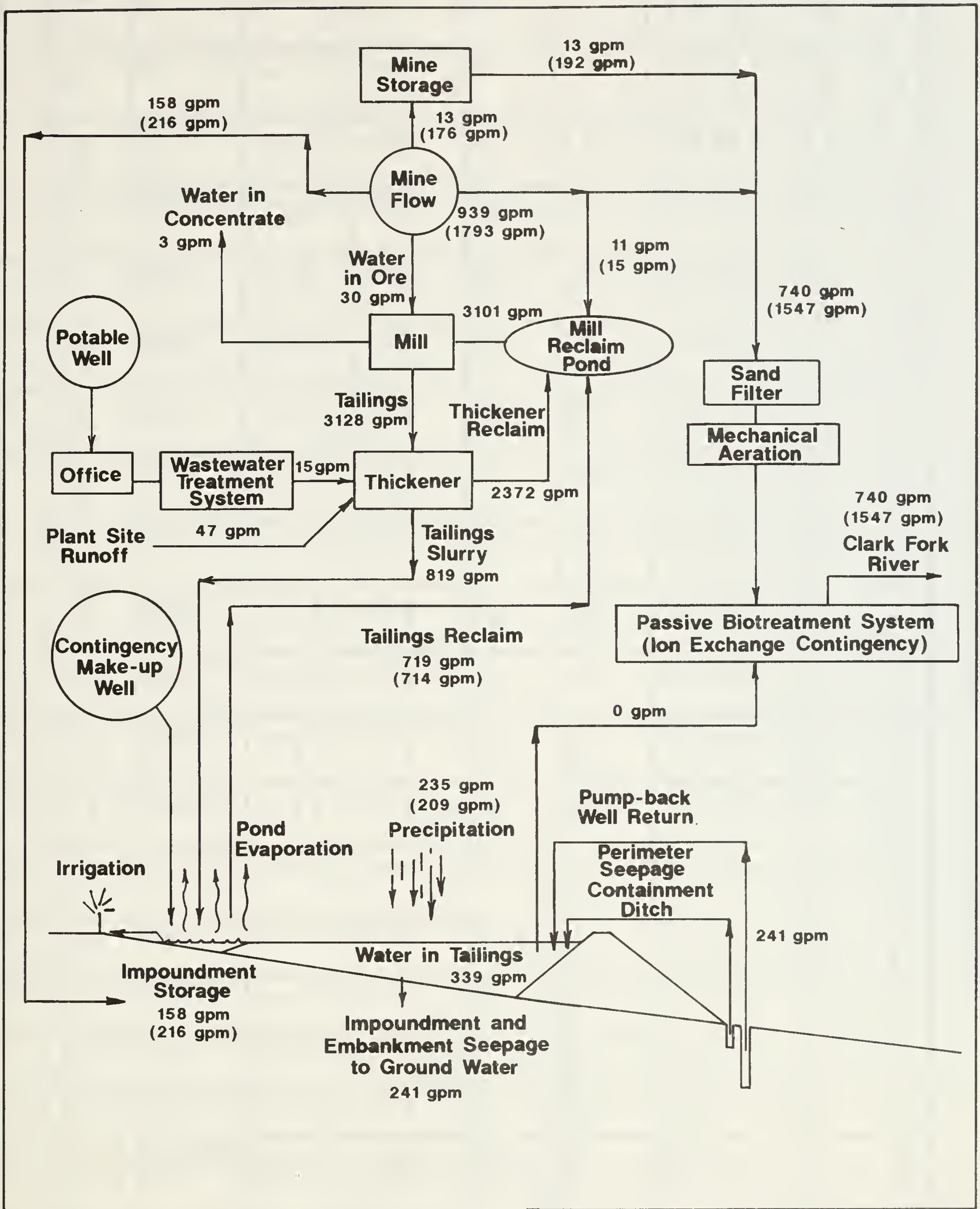

Evaluation Adit Inflow
Sand Filter
Mechanical Aeration
Passive Biotreatment System/Ion Exchange
Clark Fork River
Evaluation Adit Make-up Well
(water trucked to mine site for initial adit construction)

FIGURE 2-15
Schematic Diagram of
Water Handling (Exploration)
Rock Creek Project

Source: ASARCO, Incorporated 1995.



( ) When Year 23 Differs From Year 10

FIGURE 2-16
Schematic Diagram of Water Handling
(Mine Operations Year 10 and 23)
Rock Creek Project

Source: ASARCO, Incorporated 1995.

TABLE 2-2.
Water Balance Summary - Average Yearly Project Flows

	Line #	1	2	3	4	5	6	7	8	9	10	11	12	13	18	23	28	29	30
Adit Balance																			
Inflow																			
Adit Inflow	42	4	132	407	586	632	695	712	777	843	909	974	1040	1106	1434	1763	2091	2091	2091
Ore Water	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
Outflow																			
Impoundment Storage	44	0	0	0	0	61	38	131	145	144	158	172	160	171	199	216	184	0	0
To Biotreatment	43	4	132	407	586	571	643	556	611	676	728	772	816	851	1069	1355	1615	1796	1796
Mill Reclaim Pond	45	0	0	0	0	0	13	25	21	20	11	2	13	11	7	15	74	0	0
Mine Workings Storage	46	0	0	0	0	0	0	0	0	3	13	29	51	74	160	176	218	296	296
Ore Water	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mill Balance																			
Inflow																			
Water in Ore	66	0	0	0	0	0	20	30	30	30	30	30	30	30	30	30	30	0	0
From Mill Reclaim Pond	70	0	0	0	0	0	2042	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	0	0
Outflow																			
Water in Concentrate	67	0	0	0	0	0	2	3	3	3	3	3	3	3	3	3	3	0	0
Tailings	68	0	0	0	0	0	2059	3128	3128	3128	3128	3128	3128	3128	3128	3128	3128	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thickener Balance																			
Inflow																			
Tailings	92	0	0	0	0	0	2059	3128	3128	3128	3128	3128	3128	3128	3128	3128	3128	0	0
Waste water	93	0	0	0	0	0	12	15	15	15	15	15	15	15	15	15	15	15	15
Plant Runoff	94	0	0	0	0	0	37	47	47	47	47	47	47	47	47	47	47	47	47
Outflow																			
Tailings Slurry	95	0	0	0	0	0	539	819	819	819	819	819	819	819	819	819	819	0	0
Thickener Reclaim	97	0	0	0	0	0	1570	2372	2372	2372	2372	2372	2372	2372	2372	2372	2372	0	0
Overflow to Impoundment	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	62
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mill Reclaim Pond Balance																			
Inflow																			
Adit inflow	105	0	0	0	0	0	13	25	21	20	11	2	13	11	7	15	74	0	0
Thickener Reclaim	97	0	0	0	0	0	1570	2372	2372	2372	2372	2372	2372	2372	2372	2372	2372	0	0
Tailings Reclaim	104	0	0	0	0	0	458	705	708	709	719	728	716	719	723	714	655	0	0
Outflow																			
To Mill	102	0	0	0	0	0	2042	3101	3101	3101	3101	3101	3101	3101	3101	3101	3101	0	0
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impoundment Balance																			
Inflow																			
Post-production thickener overflow	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	62
Excess evaporation	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	160	160
From Mine for Storage	111	0	0	0	0	51	38	131	145	144	158	172	160	171	199	216	184	0	0
Tailings Slurry	110	0	0	0	0	0	539	819	819	819	819	819	819	819	819	819	819	0	0
Climate Inflow	**109**	**0**	**0**	**0**	**0**	**44**	**103**	**136**	**169**	**202**	**235**	**236**	**237**	**237**	**237**	**209**	**186**	**186**	**186**

TABLE 2-2.
Water Balance Summary - Average Yearly Project Flows (Cont'd)

	Line #	1	2	3	4	5	8	9	8	9	20	11	12	18	18	23	28	29	30
Outflow																			
Change in Storage	118-108	0	0	0	0	59	-52	-1	1	1	3	3	-2	2	6	3	1	-24	0
Evap and Dust Sup	112	0	0	0	0	123	138	174	215	245	281	287	293	298	317	318	329	329	329
Tailings Reclaim	113	0	0	0	0	0	458	705	708	709	719	728	716	719	723	714	655	0	0
Water retained in Tails	114	0	0	0	0	0	223	339	339	339	339	339	339	339	339	339	339	0	0
Net Seepage*	115	0	0	0	0	-77	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131	-131
Excess to Passive Biotreatment	134	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0	234	209
System	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mine Workings																			
Inflow																			
Inflow to Storage	122	0	0	0	0	0	0	0	0	3	13	29	51	74	160	176	218	296	296
Outflow from Storage	124	0	0	0	0	0	0	0	0	3	13	29	51	74	74	192	263	111	293
Outflow																			
Change in Storage	126-128	0	0	0	0	0	0	0	-0	0	0	0	0	0	87	-16	-45	184	3
	SUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment System																			
Treatment Inflow		4	132	407	586	571	68[illegible]	555	611	680	740	63[illegible]	867	925	1144	1547	1878	2141	2298

Note: All values are in gallons per minute (gpm).
Line # = Line number from water balance model, see Water Management Plan (ASARCO 1995).
* = A worst case seepage rate of 241 gpm was used for hydrogeologic analyses.

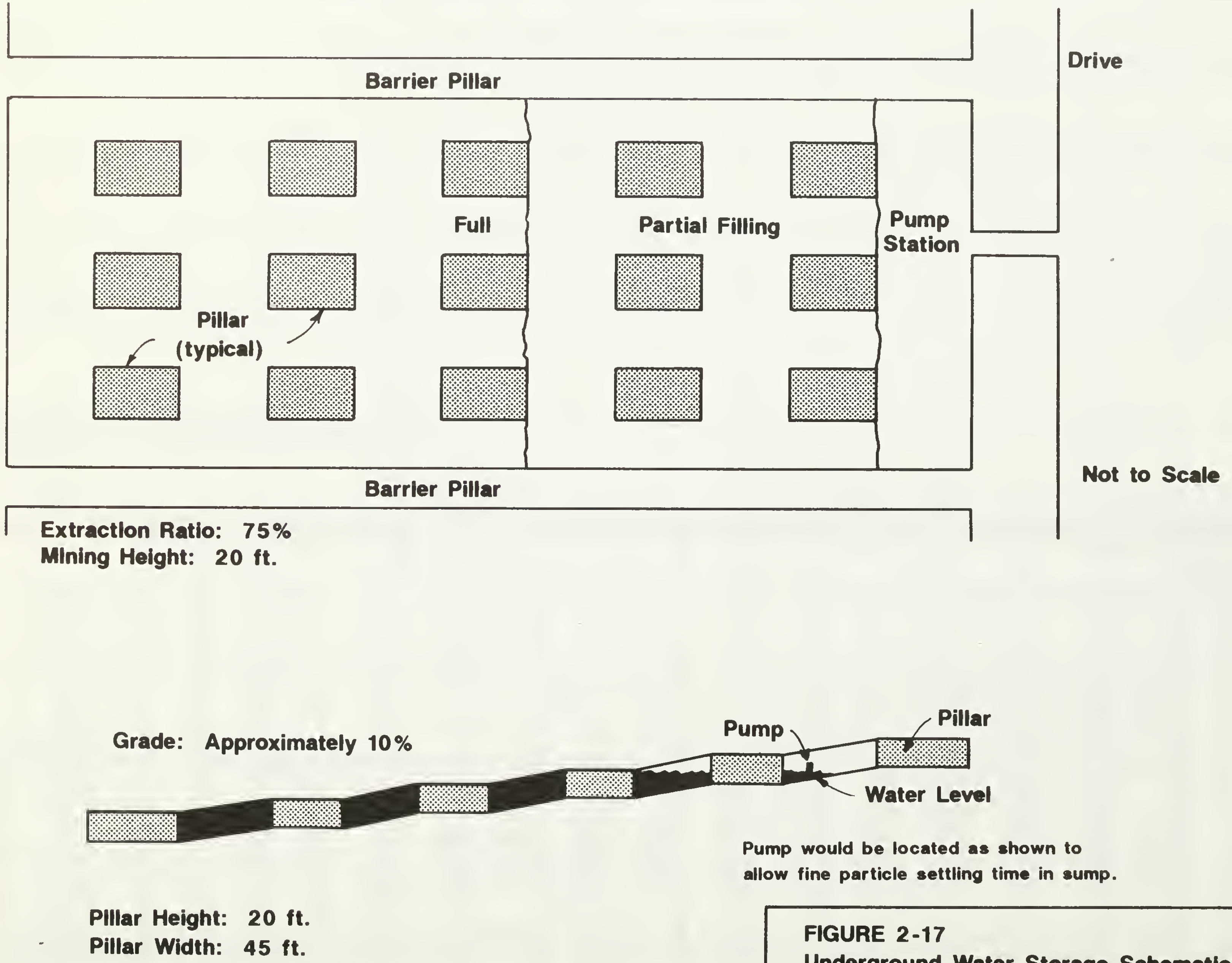


FIGURE 2-17
Underground Water Storage Schematics
Rock Creek Project

Source: ASARCO, Incorporated 1995.

Mine effluent typically would be expected to contain high concentrations of suspended solids. This would contribute a significant portion of the total metals load to mine effluent. Initial removal of suspended solids would be accomplished using two 100,000-gallon mine sumps to settle out the solids, by adding chemicals to flocculate (clump) the particles if necessary, and subsequent filtration. Water would be pumped from the mining face to these sumps for the main mine water supply.

Water originating within the mill site also would be collected and routed to a drainage sump at the mill site for use as process water. Water filters and an oil skimmer would be located in the mill area to remove suspended solids and oil and grease from the water supply. Filter backwash would be sent to the tailings thickener. Filtered water from mine and mill sumps in excess of the requirements for mine development and mill make-up water would flow through a buried 12-inch polyethylene pipeline to the water treatment facility before discharging to the Clark Fork River.

Additional settling of suspended solids would occur within the tailings impoundment. Flow would be regulated to allow sufficient settling time to remove solids within the pond on the impoundment. Excess water would be discharged through a clarifier and sand filtration unit before being routed to the water treatment system for nitrate removal.

Water treatment and effluent discharge to the Clark Fork River would meet effluent limitations in accordance with an MPDES permit from DHES. The scenario, including other elements of the project's water balance, is illustrated in **Figure 2-16** (for mine operation years 10 and 23). Water balance at the tailings impoundment would fluctuate seasonally. Decreases in water available for mill operations would be replaced by mine water, reclaim water from the impoundment, and/or makeup water as required.

ASARCO proposes to use a passive biological treatment system (passive biotreatment system) as the primary means to remove nitrate produced by the proposed Rock Creek project (ASARCO, Incorporated 1995). Under this system, water would be pretreated using filtration and settling to remove suspended solids, followed by mechanical aeration to decrease the ammonia fraction of the total nitrogen. Nitrate and some ammonia would then be removed in anaerobic passive biotreatment cells consisting of mill tailings, sawdust, manure, and alfalfa. The treatment plant would occupy a 10-acre site located northeast of the proposed tailings impoundment (see **figures 2-4 and 2-13**). The proposed passive biotreatment system would remove 80 percent of the nutrient load (see Chapter 4, Hydrology).

Engineering specifications for the proposed Rock Creek passive biotreatment system have not been prepared as part of the revised Water Management Plan. However, data were presented for a system at another ASARCO treatment facility. At the other facility, a passive biotreatment pilot cell is in operation. This cell consists of a clay-lined, compacted excavation with bottom dimensions of 40 by 30 feet, 2:1 side slopes, and a depth of 4.5 feet. The full-scale treatment facility is substantially larger, approximately 200 feet by 300 feet, and would treat approximately 1,500 gpm. The bottom 3 inches of the cell consist of a gravel/pipe effluent collection layer covered by a geotextile filter fabric. About 4 feet of substrate covers the geotextile, and an influent distribution pipe network is buried about a foot below the surface of the substrate. Water is fed to the cell from the top and allowed to gravity feed to the bottom of the substrate bed.

A pilot system would be constructed for treating adit discharge during exploration. This system would use a passive biotreatment cell with an ion exchange backup. If the passive biotreatment system worked as planned, it would be expanded for use during operation. If it could not adequately treat the volume of water or meet discharge standards, the ion exchange would be expanded.

ASARCO proposes to build cells that could treat 400 to 500 gpm each. The water balance indicates that about year 30, this system would need to grow to treat an average of 2,005 gpm. ASARCO would provide a backup treatment system consisting of ion exchange in the event that year-round treatment efficiencies using passive biotreatment technology were lower than anticipated. ASARCO has estimated that the potential cell life is at least 50 years. Spent substrate from the cells would be disposed in the tailings impoundment, unless the metals content was extremely high. In this case the substrate would be sent to a smelter to reclaim the metals. When treatment was complete, the passive biotreatment cells would be capped and abandoned in place.

The ion treatment system would be incorporated as a final polishing step in the treatment process, or as a backup system if the passive biotreatment system failed or was temporarily out of service. Ion-exchange technology would remove over 90 percent of the nitrate and some dissolved ions and metals. ASARCO has not submitted engineering specifications for the proposed ion exchange system. However, preliminary conceptual information was presented in the revised Water Management Plan. For a 650 gpm facility, 10-foot-diameter by 15-foot-tall vessels connected in series, a pump and pressure tank system to provide pressure to the exchange vessels, brine storage and supply equipment, waste brine collection equipment, and process controls and instrumentation would be required. The system for the proposed project likely would be housed in a 40-foot-by-60-foot prefabricated building, and would produce an estimated 5,800 gallons per day of waste brine. Waste brine would be disposed at a publicly owned treatment works, land-applied as fertilizer, or shipped to a manufacturer for use as an agricultural fertilizer product.

After excess water from the proposed project was treated by settling, filtration, and a passive biotreatment system, treated discharge would be piped to the Clark Fork River with a proposed outfall and engineered in-stream diffuser downstream from Noxon Reservoir. The purpose of the diffuser would be to distribute treated water though a perforated steel pipe to allow more mixing with river water. The in-stream diffuser also would reduce discharge velocities[4].

Prior to installation, a design study would be performed to evaluate streamflow conditions and streambed characteristics at the selected outfall location. The diffuser design would be finalized after the study was complete, and an appropriate method of anchoring would be selected.

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[4] The diffuser would be fixed at the bank on concrete thrust blocks and surrounded by cobble riprap to provide shoreline protection. It would lie in the river channel, perpendicular to the flow of the river. The perforations of the diffuser system would be designed to reduce the discharge velocity to less than 2 feet per second, and allow mixing to occur across a broad cross-sectional profile of the river.

Potable water for the mill and mine and mine facilities would be obtained from a fresh water well located at the north end of the mill site (see **Figure 2-11**). It is estimated that this well would produce 30 gpm.

A sewage treatment facility would be incorporated into the mill complex design. This package facility would contain the standard aeration tank with activated sludge, a settling tank with a sludge return to the aeration tank, and a chlorine contact chamber. Effluent from the contact chamber would be directed to the tailings disposal system, and sludge would be disposed of at an approved off-site facility.

Transportation

During construction of the exploration adit, access to the exploration adit site would be via existing FDR No. 150 and Chicago Peak Road, FDR No. 2741, and a short spur road. Improvements to existing FDR No. 2741 would include a minimum road width of 14 feet, improved or added road turnouts about every 1,000 to 1,500 feet, and a reconditioning of the road surface for year-round use and maintenance. Minor amounts of clearing may be necessary for turnouts and to allow for snowplowing. The short spur road would need a 14-foot wide surface to accommodate equipment. This work would be done in consultation with the Forest Service. Employees would use the parking lot at ASARCO's support facility and would be transported in four-wheel-drive vans to the adit. This would limit mine-related traffic to the minimum number of vehicles needed to transport work crews and supplies to the adit.

Because of the year-long schedule for adit construction, it would be necessary to plow snow on FDR No. 2741 for one winter. Snowplowing for FDR No. 150 would occur over mine life. Snow removal and disposal would follow Forest Service guidelines.

Traffic to the mine site would include employee commuting, weekday delivery of supplies, and hauling of concentrate by truck to the Hereford load-out. To access the proposed mill site, vehicles would use FDR No. 150 for about 6.5 miles. Starting at Montana Highway 200, ASARCO proposes to relocate about 7,100 feet of FDR No. 150 to bypass the tailings impoundment. Both the relocated and existing roads to the mill site would be upgraded to a 24-foot paved surface to handle the projected traffic load (see **Figure 2-18**). A new bridge over Rock Creek would be required at the junction of the new and existing road. The two existing bridges on FDR No. 150 over Rock Creek would be replaced. FDR No. 150 and associated bridge construction and reconstruction below the proposed mill site would be done during the last half of the year of exploration adit construction (see **Figure 2-4**). For public safety and mill complex security, ASARCO also proposes a relocation of about 5,900 feet of FDR No. 150 around the proposed mill site (see **Figure 2-11**). Beyond the mill's main entrance, the relocated single-lane graveled road would be built to Forest Service standards.

An extension to the culvert on the WFRC above the last bridge on FDR 150 is proposed.

ASARCO proposes to construct an 8,800-foot mine access road from the mill site to the mine portal (see **figures 2-11 and 2-19**). This road would have a 20-foot-wide gravel surface.

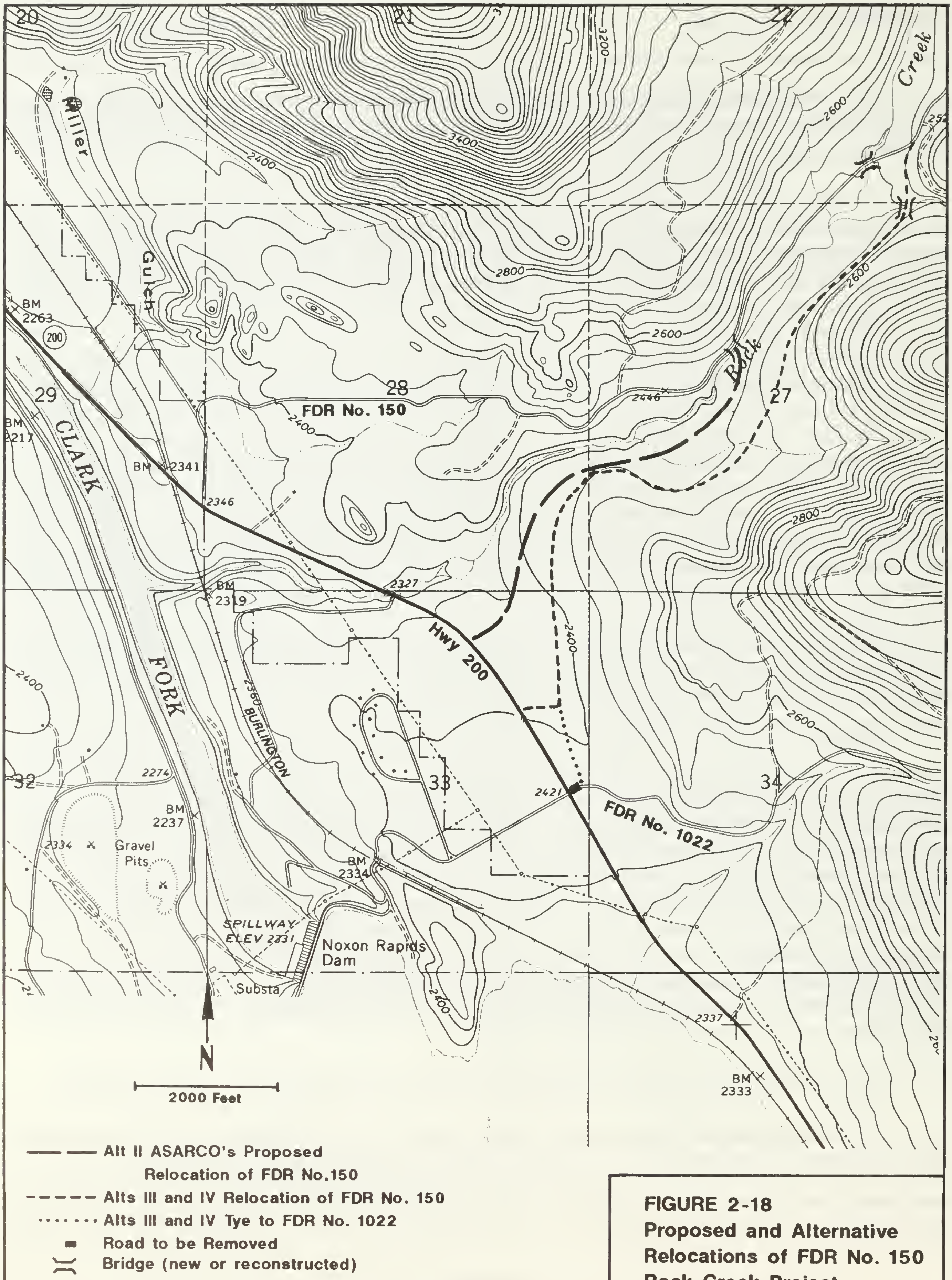


FIGURE 2-18
Proposed and Alternative Relocations of FDR No. 150
Rock Creek Project

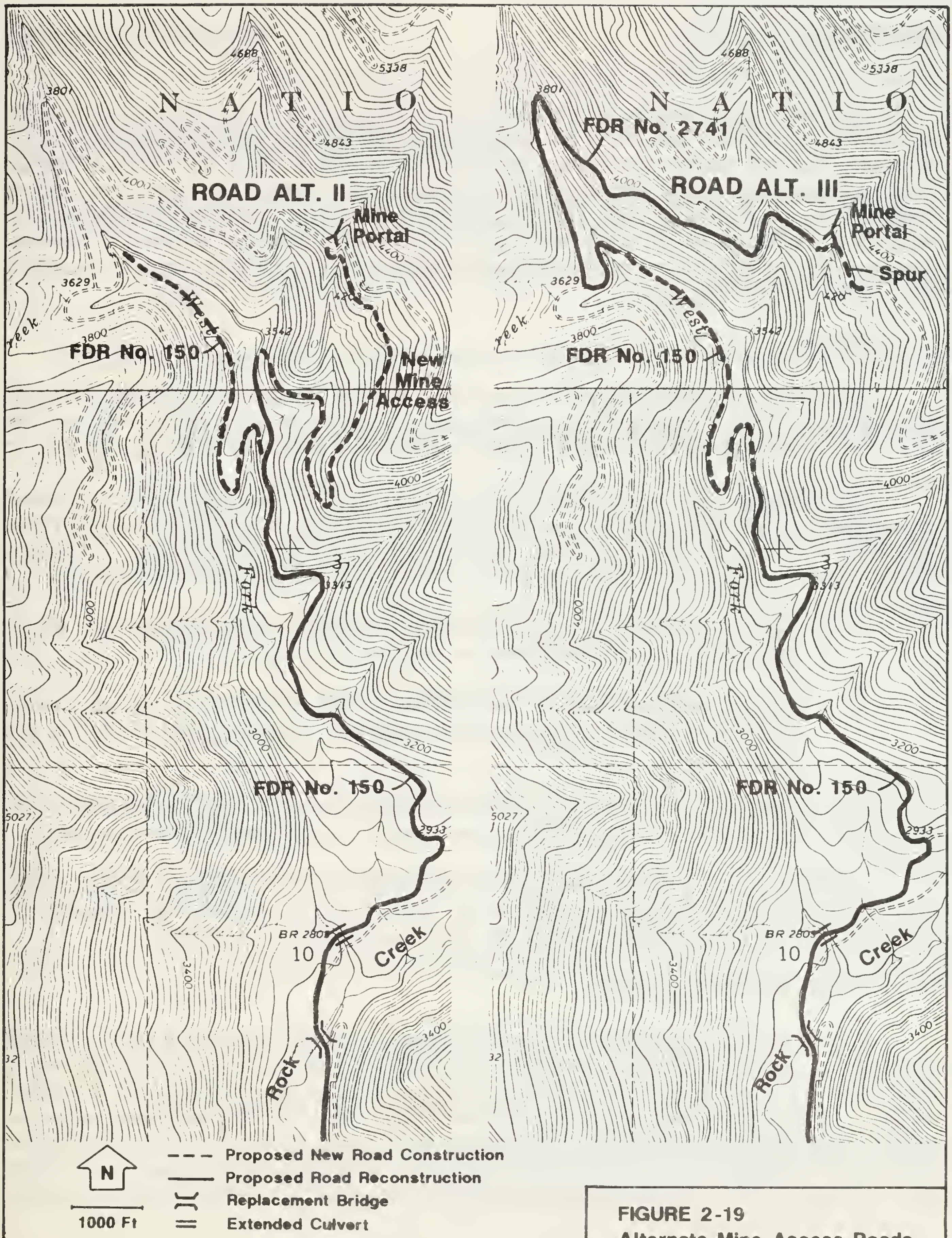


FIGURE 2-19
Alternate Mine Access Roads
Rock Creek Project

Additional gravel roads or maintenance trails would be required to provide access to the utility corridor where it does not follow FDR No. 150 (a 14-foot-wide road for pipeline maintenance, repair, and monitoring), the reclaim pump station and tailings impoundment (FDR No. 150B and seepage collection system road), and the surface conveyor (see **Figure 2-4**). ASARCO would be responsible for maintaining these mining-related roads and trails. Maintenance of FDR No. 150 would be ASARCO's responsibility, unless additional use by the Forest Service or other interests warranted a cost-share agreement. Upon completion of mining activities, those roads needed for public use would be maintained by the county or Forest Service.

Utilities

There would be no electric lines to the exploration adit site. During the year of exploration adit construction, two 500-kW diesel generators would provide power for the drills, pumps, vent fans, and shop. Electric power for support facilities would be supplied from an existing local distribution line.

A 230 kilovolt (kV) electrical service to the mill site would be provided via a new, overhead transmission line. ASARCO proposes to use 61-foot-high wooden utility poles within a cleared 100-foot right-of-way. One switchyard may be constructed adjacent to the Noxon/Libby 230 kV line near Highway 200 in a dedicated powerline right-of-way. Two new substations would be constructed:

- one would be constructed at the mill site to distribute electricity through lower voltage lines to equipment within the mill site, adit, and mine; and
- a second would be constructed near FDR No. 150 in the vicinity of the impoundment for electrical distribution to that area. This would involve clearing a 100 by 100 foot area and fencing it.

All transmission distribution lines (4.16 kV and smaller) would be buried in conformance with KNF policy. The transmission line and all substations would be removed during mine reclamation.

ASARCO has selected Washington Water Power (WWP) as its power provider. ASARCO would be responsible for paying all construction costs for the substations and transmission line. Annual power consumption is estimated at 95,000,000 kW-hours, with a peak demand of 13,300 kW.

Erosion and Sediment Control

Wind and water erosion control measures are described in detail throughout ASARCO's permit application in operation and reclamation plans. These measures involve 1) mechanical practices to minimize fugitive dust, 2) grading to reduce erosion potential, 3) soil-handling techniques to enhance stability, 4) hydrologic systems to control runoff and sedimentation, and 5) revegetation practices to provide a stabilizing cover. (Soil handling and revegetation measures are discussed in more detail under Reclamation.) ASARCO would follow Forest Service soil and water conservation practices. A storm water discharge permit would be required from DHES. As part of this permit, ASARCO would be required to submit a storm water management plan for DHES approval. This plan would describe the methods to minimize and control runoff contamination.

Fugitive Dust Control. During the construction and operational phases of the project, the following procedures would be used to control emissions affecting air quality.

- The main access road (FDR No. 150) to the mill facilities would be paved (see **Figure 2-4**).
- All unpaved roads would be watered or a dust palliative used as needed to reduce fugitive dust.
- Waste rock, soil, and other dust-forming debris would be promptly removed from roads.
- Vehicle speeds would be restricted on haul roads to reduce the amount of fugitive dust.
- Revegetation, mulching, and stabilization of road cut-and-fill areas would occur in the first appropriate season after construction.
- Revegetation of other disturbed soils would occur in the first appropriate season after disturbance.
- Vehicular traffic would be restricted to established roads.
- The area of land disturbance would be minimized.
- Dust generated at loading and transfer points would be restricted with dust collection systems.
- Emissions from ore processing would be restricted with water sprays or dust collection systems.
- Heavily used haul and access roads would be chemically stabilized with nontoxic soil cement or dust palliatives mixed into the upper 1 to 2 inches of road surfaces as necessary.
- A covered conveyor system would be used to minimize emissions.
- Blowing tailings would be controlled using a sprinkler system.
- Proper maintenance would be performed to minimize gaseous emissions from internal combustion engines.

Site Grading. Erosion potential would be minimized by the following measures.

- Rills and gullies would be stabilized and revegetated.
- Slopes would be visually inspected periodically throughout the operation to detect early signs of impending slope failure.
- Road grades would be designed to disrupt natural drainage patterns as little as possible.
- Surface drainage from unpaved roads would be indirectly channeled to streams.
- The overall slope of the tailings dam face would be 3:1.
- Erosion bars or drive-through dips would be constructed on unpaved roads.
- Disposal methods for tailings would prevent runoff over the dam face.
- Equipment would work along contours where possible to minimize creation of channels. When work on slopes must be perpendicular to contours, crawler tracking or dragging would be used to reduce channeling effects of grading.

Soil-handling Techniques. The following activities would be conducted to reduce potential erosion.

- Soil salvage would occur incrementally (when feasible) with disturbances to minimize the area exposed at any given time. This would reduce the length of time soil remained stockpiled and reduce wind and water erosion associated with soil salvage.
- Soil stockpiles would be located and designed to minimize wind and water erosion. Stockpiles would be located away from drainages on the gentlest slopes available. Stockpiles would be designed with 2.5:1 sideslopes and would be revegetated for stabilization.
- ASARCO would direct-haul (taking directly from the excavated site to a reclamation site) soil whenever feasible.

Hydrologic Measures. The following steps would be taken to control runoff and sedimentation. For more information, see ASARCO's storm water plan and revised water management plan (ASARCO, Incorporated 1995).

- A drainage and diversion system would be constructed at all disturbance sites to control runoff and sedimentation during the operation period. This system would include diversion of off-site runoff waters and containment of runoff and sediment from disturbed areas.

- Windrows of woody debris or logs would be placed parallel to slope contours at the bases of long fills.
- Rights-of-way clearing would be minimized to reduce the total area susceptible to erosion.
- Naturally occurring runoff from hillsides above the mill site would be diverted around the site (see **Figure 2-11**).
- Two intermittent streams would be routed through the mill site in engineered channels to avoid conflicts with mill activities.
- Collection and routing of all water originating within the mill site would be routed to a drainage sump for use as process water.
- A sediment containment system downstream of disturbed areas would prevent sedimentation in natural drainages in the area.
- A diversion system would be constructed at the toe of the proposed waste dump. This ditch would intercept any runoff from the waste dump and divert it through a series of sediment control ponds prior to returning the water to the natural drainage.
- During the life of the operation, seepage collection ditches would intercept sedimentation originating from dam faces.
- Naturally occurring runoff from undisturbed hillsides above the exploration adit site would be diverted around the site in a structure sized to convey a 24-hour, 25-year storm event (see **Figure 2-7**).
- Collection and routing of all water originating within the exploration adit site would be routed to the lined pond and then pumped to the adit sump for precipitation of suspended solids and skimming of oils. Excess surface drainage would be discharged from the pond through an overflow structure into the pipeline to the passive biotreatment system prior to draining to the Clark Fork River.

Revegetation Practices. The following practices would be used during the operational phase to provide a permanent, stabilizing plant cover.

- Rapidly developing and sod-forming plant species would be included in the seed mixture to provide rapid stabilization.
- Revegetation would occur in the first appropriate season after soil redistribution.

- Mulch (or tackifiers on hydromulched areas) would be applied to aid in erosion control and moisture retention.
- Revegetated areas would be protected from disturbance by banning traffic until vegetation became established.
- Interim revegetation would be used to stabilize disturbed areas.
- Trees would be planted in years 34-35 (end of mine life) on the tailings impoundment face and surface for stabilization, wildlife edge, seed source, and screening.
- Shrubs would be planted on road cut-and-fill slopes if necessary to reduce erosion.
- Seedbed preparation and seeding activities would be conducted on the contour on all slopes. Slopes less than 33 percent would be drill seeded. Rocky areas and slopes exceeding 33 percent would be broadcast-seeded.

Precipitation would retard blowing tailings during winter and spring. ASARCO would use sprinkler irrigation to abate dust during dry periods. Since the impoundment surface would be continually rising, interim tailings stabilization by sprinkling would be ongoing. Long-term tailings stabilization and reclamation would be provided by capping the impoundment surface with soil and revegetating. More specific requirements would be contained in the air quality permit for the project.

Employment

Development of the exploration adit would require 3 months to mobilize and set up, 8 months to drive the adit, and 1 month to demobilize. Development would start with 20 employees in the first quarter, and then gradually increase from 43 employees in the second quarter to a maximum of 55 employees in the fourth quarter.

The mine construction phase of the project would include access road construction, adit development, mill site construction, access road renovation, tailings embankment construction, and installation of service facilities over a 36-month period. ASARCO would use both company employees and contractors. Construction would start with 44 ASARCO employees in the first quarter and peak during the twelfth quarter with 240 employees. Contract employment for construction would start in the first quarter at 248 and peak during the fifth quarter at 345. ASARCO would have no direct control over contract labor schedules. It is assumed that the contractor would require a 7-day work week with more than one shift per day.

Following the initial mine construction phase, the underground facilities, and mine/mill complex would be brought to full production in the fourth year, with operating personnel increasing from 260 to 355 by the end of the year. Permanent employment is projected to stabilize at 355. Permanent project facilities would operate 24 hours per day, 7 days a week, 354 days a year.

Following the proposed 30-year mine life, ASARCO would employ 35 workers to remove equipment and reclaim the mine facilities for at least 2 years.

Because the local labor force initially would not have all required skills for development and production jobs in the mine, ASARCO proposes to conduct intensive training programs, both in the classroom and on the mine site.

Reclamation

Short-term reclamation objectives are to stabilize disturbed areas and to prevent air and water pollution. The long-term reclamation objective is to establish a postoperational environment compatible with existing land uses and consistent with the Forest Plan. Specific reclamation objectives include the following:

- permanent protection for air, surface water, and ground water resources;
- protection of public health and safety by removing potential hazards;
- maintenance of public access through the project area;
- restoration of wildlife habitat;
- design of a land configuration compatible with the watershed;
- re-establishment of an aesthetic environment allowing for visual quality and recreational opportunity; and
- re-establishment of postoperation biological potential suitable for supporting vegetative cover appropriate to the area.

To accomplish these objectives, ASARCO proposes to provide interim and postmine stabilization of most disturbed areas; to follow measures described under Sediment and Erosion Control; and, after mining, to reclaim all disturbed areas by recontouring and redistributing soil, and revegetating.

Postmining Topography. All buildings and other structures at the exploration adit support facilities site would be removed once the mill site was operational. It is estimated that the support facilities would be used through exploration and the first 3 to 4 years of mine construction and operation. This site would be recontoured to approximate original contours.

The tailings impoundment would be reclaimed to the configuration shown on **Figure 2-20**. The 3:1 side slopes, having undergone concurrent reclamation (see Revegetation) during construction, would remain as constructed during the operational phase of the project. The final perimeter dikes, beach, and pond area located on top of the tailings impoundment would be graded as shown on **Figure 2-20** once the pond area had dried sufficiently to allow equipment access.

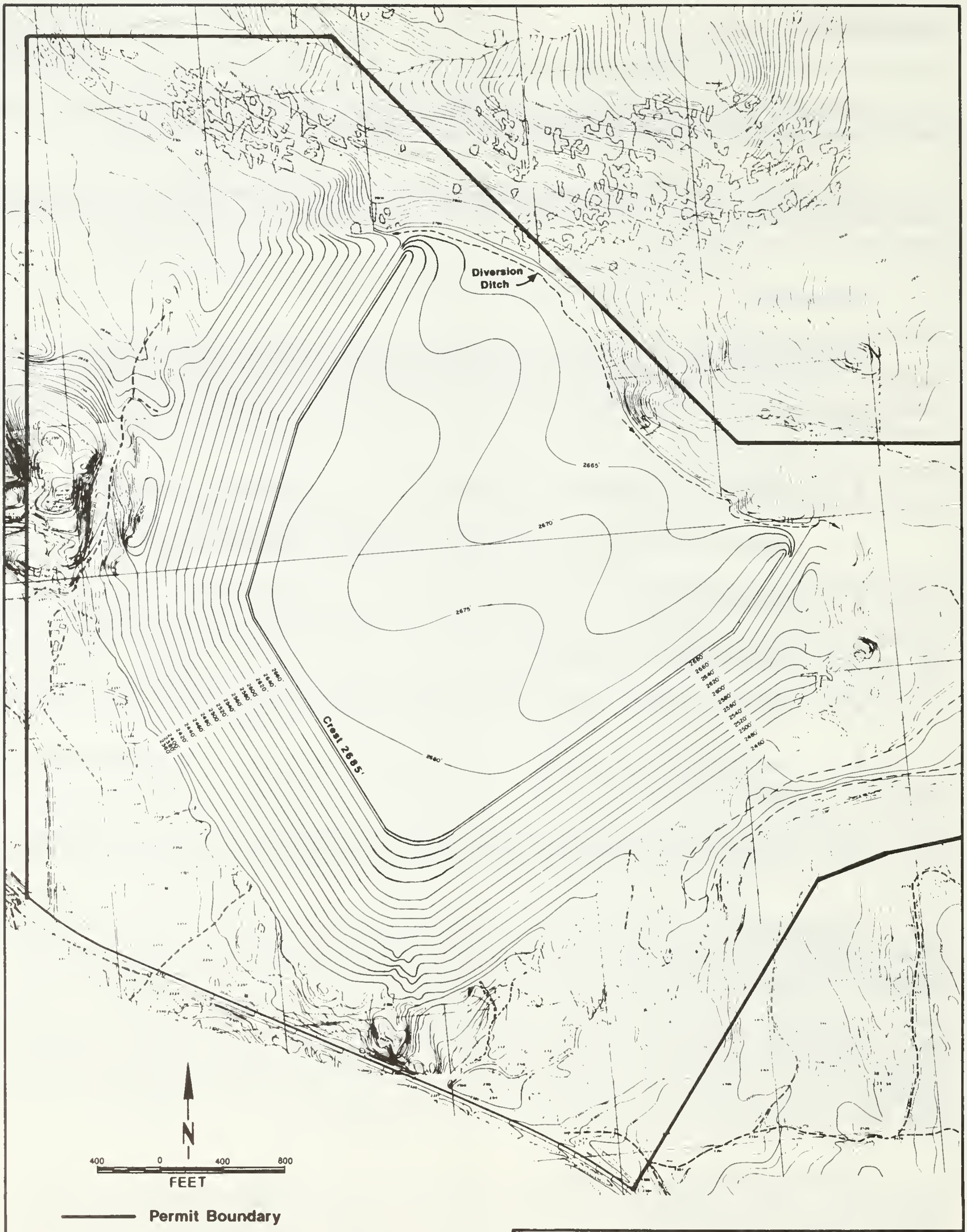


FIGURE 2-20
Alternative II Postmining Topography of the Tailings Impoundment
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

The diversion structures above the reclaimed tailings impoundment would remain as permanent stream channels to route runoff around the reclaimed tailings mass. All mechanical facilities associated with the tailings impoundment would be removed. The remaining surface disturbances (e.g., runoff control ditches along the embankment toe, seepage capture and return ponds, and facility pads, water reclaim facility sites, soil stockpile sites, emergency dump ponds, and internal and perimeter access roads) would be returned to approximate original contour.

After mining and ore processing were completed, all buildings and related equipment and infrastructure, the conveyor, powerline, and surface tailings lines would be dismantled and removed. The reclaimed configuration of the mill site would result in an expanded bench sloping southeast. The area would be graded to the final topography shown in **Figure 2-21**. Internal roads and parking areas would be graded to approximate original contours. Paving material would be buried on site or removed to a disposal facility. Inert waste such as steel, concrete, plastic, or wood would be buried in on-site waste disposal areas or sold to scrap dealers for recycling; some waste may be transported to an approved waste transfer station as authorized by the county solid waste district. It is assumed that buried pipelines would remain in place.

Once ground water quality beneath the impoundment met water quality standards, and ASARCO was given permission to shut down the ground water pump-back system, all surface components would be removed, wells capped, and the sites regraded according to approved plans. When the water treatment facility would not be needed for treating mine adit discharge, the buildings, related equipment and surface discharge pipelines would be removed and the site regraded to approximate original contour.

The waste rock dumps for the mine and exploration adits would become generally flat-topped benches sloping southeast, about 1 and 2 percent, respectively. The face of the exploration adit waste rock dump would have a 2:1 slope while the mine waste rock dump would have a 1.25:1 slope.

A channel would be constructed across the exploration adit waste rock dump from the area of the backfilled lined pond to the access road cut to connect natural drainage areas above and below the exploration adit dump. This channel would be lined with coarse rock to prevent erosion. Disturbances other than the exploration adit waste rock dump (i.e., facilities area, diversion ditches, fuel storage area) would be graded to blend with adjacent undisturbed topography.

Mine and exploration adit portals would be permanently closed by a bulkhead (concrete closure), leaving a near-vertical face. Both 1-acre benches in front of the portals would be sloped to drain at about 1.0 percent to the southwest.

The wilderness ventilation adit would be reclaimed. The grate and fan would be removed and the adit would be sealed with a 12-inch-thick bulkhead. The bulkhead would be constructed from within the adit using reinforced concrete. Equipment removal and plugging would be conducted from inside the adit.

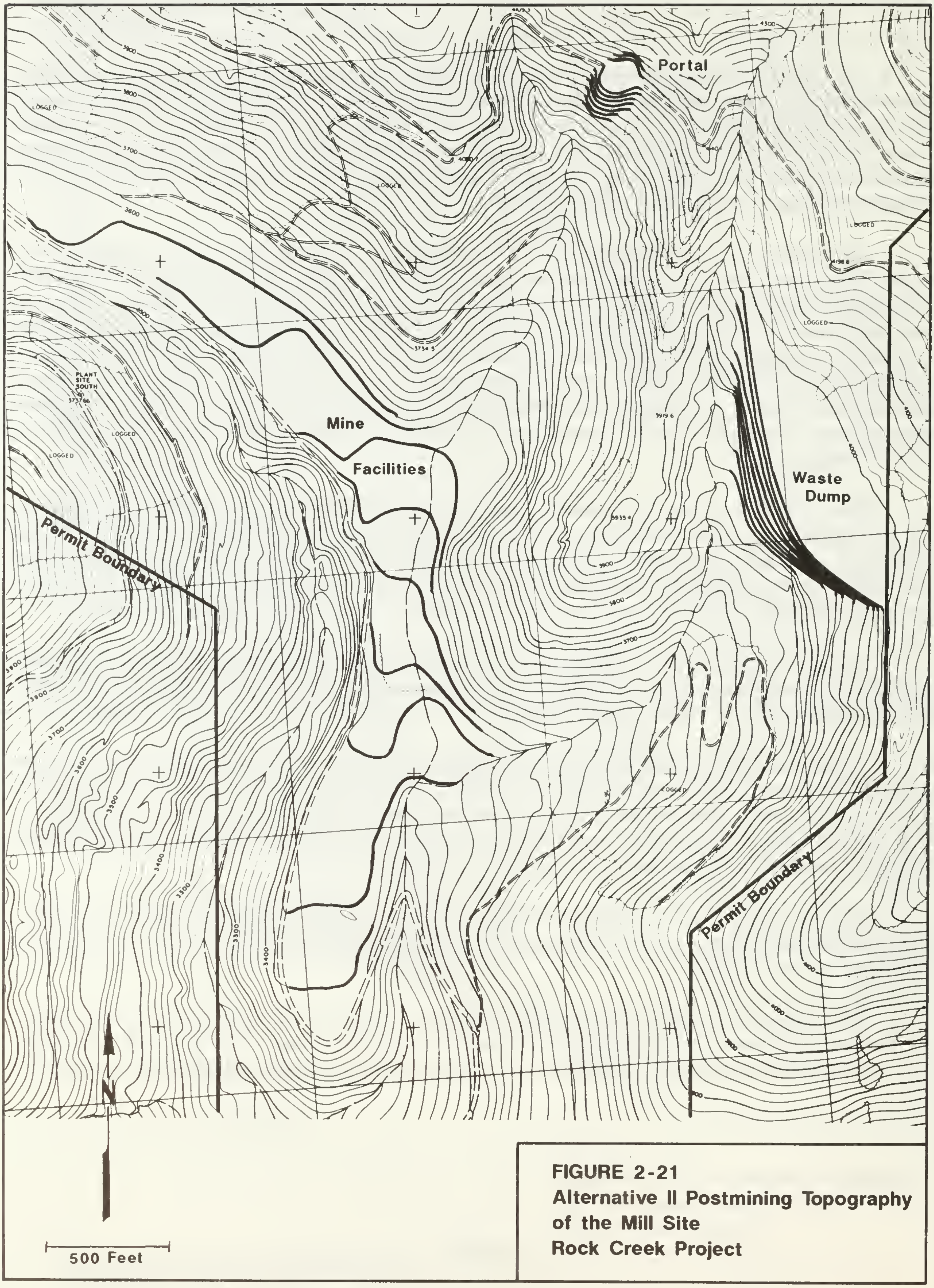


FIGURE 2-21
Alternative II Postmining Topography
of the Mill Site
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

The borrow areas would be reclaimed to approximate original contours with slight steepening at the upper contact with natural grade and flattening at the lower contact. Transition areas from natural to reclaimed areas would be smoothed, rounded, and graded to drain substantially the same as the original configuration.

New access roads designated for public use would remain in place. Mine access road and other project-related roads would be reclaimed if not needed for long-term monitoring and water treatment.

Soil Salvage and Handling Plan. Soils salvaged from the exploration adit site would be removed in two lifts where soil was available and where slopes were less than 2:1. The soil would be stockpiled northwest of the exploration adit (see **Figure 2-7**). All of the first lift soil and half of the second lift soil would be redistributed over the adit, waste rock dump top, and facilities to an average total depth of 12 inches. The remaining second lift soils would be redistributed over a portion of the slope face of the dump designated for revegetation at an average depth of 13 inches over 1.9 acres. Approximately 1.4 acres on the waste rock dump would be left as talus to achieve a mosaic appearance.

Soils would be salvaged from about 0.4 acres at the proposed parking lot and garage/warehouse at the proposed exploration support facilities site and stockpiled just west of the parking lot. Soils would be replaced once the buildings and other features had been removed and the site regraded.

Soils would be salvaged in a single lift from disturbed areas at the mill site and impoundment where slopes were less than 2:1 and where coarse fragment (rocks greater than 2 millimeters) content was less than 50 percent, with the exception of soil stockpile sites and other miscellaneous areas. (See **Table 2-3**). Slopes over 50 percent are considered unsafe for conventional salvaging techniques. Soils containing coarse fragments in excess of 50 percent by volume are considered unsuitable for salvage. The suitability of soils proposed for reclamation was determined from physical and chemical data collected during the baseline soil survey (ASARCO, Incorporated 1987-1994).

Soil would be direct-hauled or stored in stockpiles as close to eventual redistribution sites as possible (see **figures 2-4, 2-7, 2-11, and 2-13**). Direct-hauling would occur primarily at the tailings impoundment. Measures would be taken to minimize compaction and handling. Reclaimed soil depths would average about 9.5 inches on the tailings pond and associated disturbances, 11.4 inches on the facilities site, waste rock dump top, and mine area, and 14.3 inches along the transportation corridor.

Prior to redistribution, compacted areas (especially the waste rock dump top, roads, soil stockpile sites, and facilities area) would be ripped with heavy equipment to relieve compaction. This would eliminate potential slippage at layer contacts and promote root penetration. Soil salvage and redistribution would occur throughout the life of the operation.

Soil stockpiles would be constructed with a 2.5:1 side slope and 3:1 ramps. As stockpiles reached their design capacity, they would be stabilized and seeded. Seeding would be conducted during the first appropriate season following stockpiling. Fertilizer and mulch would be applied to the piles as necessary.

TABLE 2-3.
Soil Salvage Summary

Disturbance	Soil salvage area (acres)[1]	Salvageable topsoil (yd^3)[2]	Stockpile number
Exploration Adit			
-Portal area\first lift -	7.7	2,369	exploration adit site
-Portal area\second lift	2.0	6,388	exploration adit site
-Subtotal for portal area	7.7	8,757	
-Support facilities	2.0	4,195	adjacent to parking lot
Tailings impoundment & associated components			
- Dam faces & impoundment surface	324	378,770	1, 2
- Borrow areas 2 & 3	27.2	48,642	2
- Roads (access, haul)	5.4	9,290	adjacent to road
- Water control structures	0.2	17,141	adjacent to structure
- Pump station	0.2	323	2
Transportation corridor			
- Access road	16.9	32,024	adjacent to road
- Tailings line corridor	40.0	19,560	adjacent to corridor
- Emergency impoundments	2.0	6,388	adjacent to impoundment
- Fresh water well	0.2	485	adjacent to well
Water treatment facility	10.0	32,269[3]	2
Mill facilities			
- Fenced area	40.0	91,840	3, 4
- New public road	0.1	7,341	4
- Fresh water well	0.1	81	adjacent to well
- Water control	1.5	929	adjacent to structure
Mine			
- Access road	0	0	
- Waste rock dump	0	0	
- Portal area	0	0	
- Water control structures	0	0	
Total	**458.7**	**664,706**	

Source: ASARCO, Incorporated 1986-1993.

Note: [1] Total soil salvage acreage does not equal total disturbance acreage in **Table 2-1** because soil would not be salvaged from the mine, soil stockpile sites, powerline and conveyor corridors on slopes that exceeded 2:1, or areas where soil has already been removed (such as existing roads). Soil stockpiles are shown on **figures 2-4, 2-7, 2-11 and 2-13.**

[2] Volumes represent in-place measurements; yd^3 = cubic yards.

[3] Volumes estimated by the Agencies.

Revegetation. ASARCO proposes to meet short- and long-term objectives stated in its revegetation plan. The plan specifically addresses species selection for final and interim seed mixtures and planting schemes, seeding and planting rates, seedbed preparation, seeding and planting methods, cultural treatments, and interim revegetation. The proposed seeding and planting mixes are presented in **Appendix G** and ASARCO's Reclamation Plans (ASARCO, Incorporated 1987-1994).

The proposed species selection and seeding/planting rates are based on preoperation vegetation types, environmental tolerance, species that exhibit hardiness on postoperation sites, and a variety of other factors. An understory seed mix consisting of grasses and forbs would be used on all disturbance areas. Shrubs would be seeded on most sites, but not on the exploration adit site or the transportation and utility corridors.

Grass species proposed, including both native and non-natives, are typical of those used for reclaiming sites in similar settings. Forbs and shrubs proposed are native species that typically occur in one or more of the communities identified within the project area. Alsike clover, a non-native forb, is proposed to ensure that important nitrogen-fixing processes occur. An annual cereal grain would also be added to the mix to ensure rapid cover. Seed mixtures may be modified due to limited species availability, poor initial performance, advances in reclamation technology, or a variety of other factors.

Seeding rates would average about 120 pure live seeds per square foot (13 to 16 pounds per acre) for drill seeding and roughly twice that for broadcast seeding. Drill seeding would occur on slopes of less than 3:1 (horizontal to vertical) that are not rocky as determined by the Agencies. Steeper slopes and rocky areas would be broadcast or hydroseeded (a technique where seed is mixed into a slurry and sprayed onto a slope). Seeding would occur in the first appropriate season following site preparation.

ASARCO proposes a number of cultural treatments for seedbed preparation. Sites would be prepared for seeding by grading; ripping to prepare the surface for soil placement; respreading salvaged soil; and tilling soils on gentle slopes (3:1 or less) to break up clods and relieve compaction, as needed. Phosphorus fertilizer, important for seedling establishment, would be applied prior to seeding. Once seeding occurred, straw mulch would be applied and anchored according to slope steepness and seeding method. Nitrogen fertilizer would be applied early in the subsequent growing season to enhance growth.

Trees would be planted on slopes that do not exceed 3:1 in the tailings impoundment area, the facilities area, the waste rock dump top, and the access road to the waste rock dump. Trees would be planted in 2-to-4-foot-wide strips alternating with 8-foot-wide strips that were drill seeded. Trees would be planted 6 feet apart to achieve an initial stocking rate of 663 trees/acre. Reforestation of the transportation corridor and the exploration adit area would rely on natural regeneration. Shrubs would be planted on the tailings impoundment face. Shrubs would be planted on the access road cuts, only if herbaceous vegetation was not providing adequate erosion control.

Interim revegetation would take place on many disturbed areas to reduce erosion and sedimentation until final reclamation could be implemented. These areas would include roads, soil stockpiles, the utility corridors, and other areas. The seed mix is the same grass mix proposed for final reclamation. Areas would be broadcast seeded or hydroseeded, mulched, and fertilized.

Throughout mine life, disturbances would be seeded as they occurred with the interim seed mix. Final revegetation (seeding) would occur in some areas during the preoperational phase; others would be revegetated incrementally when possible, such as the impoundment face. Final revegetation of all other disturbances not previously reclaimed would be completed within 2 years after mining except the tailings impoundment which would be reclaimed within 2 years after drying. Trees and shrubs would be planted on the impoundment face after operations ceased so that the dam face could be inspected for stability during the operational phase. Elsewhere, trees would be planted in the first appropriate season following final revegetation.

Monitoring and Mitigation Plans

Air Quality Monitoring. ASARCO would be required to monitor air quality around the operation as part of its air quality permit. The specifics of the monitoring plan would be reviewed annually. The purpose of the plan would be to evaluate the effectiveness of implemented air pollution control technologies.

Soils and Erosion Control. All reclaimed areas would be inspected for erosion in spring and fall until they became stabilized. Evidence of erosion would be repaired and reseeded. An approved monitoring schedule would be developed for the tailings impoundment during the final design phase.

Soils would be tested for fertilizer needs and macronutrient content. Tailings and waste rock would be sampled for constraints to revegetation including texture, coarse fragment content, and pH. Structural measures would be taken to prevent erosion and sedimentation.

Revegetation. Revegetated areas would be field checked during the first season following revegetation to determine success. Monitoring would include qualitative evaluation of cover, species composition, and tree planting success. If problem areas were identified, remedial action would be taken. Evaluation of site-specific reclamation would also be conducted on rights-of-way, the tailings dam face, and waste rock dump. Evaluation parameters would include species response, soil distribution depth, planting techniques, effects of fertilizer rates, and reclamation success on steep, rocky slopes.

After final reclamation, revegetated areas would be protected for 2 years where necessary from vehicle and livestock use. Control of wildlife damage would be attempted. A noxious weed control plan would be developed in accordance with the Sanders County Weed District and, where applicable, with Forest Service guidelines. No postoperational treatments (except nitrogen fertilizer) would be implemented other than normal forest practices.

Fish and Wildlife. ASARCO's fish and wildlife mitigation plan was formulated to minimize and/or mitigate the effects of the mine operation. Mitigation measures proposed include the following:

- conspicuously posting all applicable state and federal hunting, fishing, trapping and recreation regulations. Meeting with appropriate regulatory agencies to discuss regulations to be posted, locations of signs, and any special regulations pertinent to adjacent lands;

- developing and enforcing wildlife policy to prohibit carrying of firearms in ASARCO vehicles, hunting within ASARCO property by employees and the public, unauthorized off-road vehicle use in the project area, and to discourage wildlife harassment and littering;

- minimizing vehicular disturbance by dust suppression, paving, speed limit enforcement, and encouragement of carpooling;

- cooperating with appropriate agencies regarding trespass, game violations, or other wildlife problems; and

- maintaining access to public lands adjoining the project area.

Threatened and Endangered Species. A plan was developed to mitigate effects on threatened and endangered species. In addition to the measures suggested above for wildlife, ASARCO would:

- construct powerlines following criteria outlined by Olendorf, Miller, and Lehman (1981) to reduce potential for electrocution of bald eagles;

- develop and implement a grizzly bear management program in conjunction with appropriate state and federal agencies; and

- not use clover in the seed mix used on any disturbed area during active operations to reduce grizzly/human encounters caused by bears being drawn to clover sites.

Water Monitoring Plan. ASARCO's water monitoring plan includes baseline, operational, and postoperational monitoring of surface and ground water resources. The postoperational monitoring program would be modified based on operational monitoring results prior to the termination of mining activity. Plans would be subject to review and final approval by DHES, DSL, and KNF.

Rock Mechanics Monitoring. ASARCO proposes to employ experience gained from its Troy Mine, and field observations adapted to rock mechanics theories and practices for designing this mine. Data from the exploration adit also would be incorporated.

Tailings Impoundment and Tailings Slurry Line Construction Monitoring Plan. The construction monitoring plan for the tailings impoundment and the tailings slurry line is divided into four discrete time segments. The intent of the monitoring plan is to provide the Agencies with the information necessary to judge whether the facilities are being constructed and operated within the design and performance standards set forth in the application and existing permits. The four time segments are as follows:

- Final Design Phase: Agency review and approval of final designs for tailing impoundment, tailings slurry lines, and emergency dump ponds.

- Preproduction Construction Phase: Standard inspection and quality control procedures would be implemented with periodic interim construction reports submitted at 2-month intervals during construction of tailings starter dams. A final construction report would be submitted prior to operation. This report would contain as-built drawings.

- Operational Phase: Monitoring would continue throughout project life and would include routine inspections and reports of facility geometry, material specification, embankment drainage, foundation pore pressure, and observational performance.

- Interim Facility Shutdown: In the unlikely event of a shutdown, the tailings impoundment monitoring plan would be continued.

Hard Rock Mining Impact Plan. A Hard Rock Mining Impact Plan would be negotiated between ASARCO and Sanders County to moderate most direct financial impacts that local government service providers would experience as a result of worker immigration and turnover.

Provisions of the Hard Rock Mining Impact Plan would, if necessary, provide mechanisms for sharing project revenues with local jurisdictions that experienced impact from the project but did not receive increased tax receipts.

An economic impact mitigation plan (part of the Hard Rock Impact Plan) is being prepared by ASARCO. ASARCO's plan will be presented to the Hard Rock Impact Board after the draft EIS is published but prior to the final EIS. Sanders County has retained consultants to evaluate and negotiate with ASARCO on the economic impact mitigation plan. (See Chapter 1, Agency Responsibilities.)

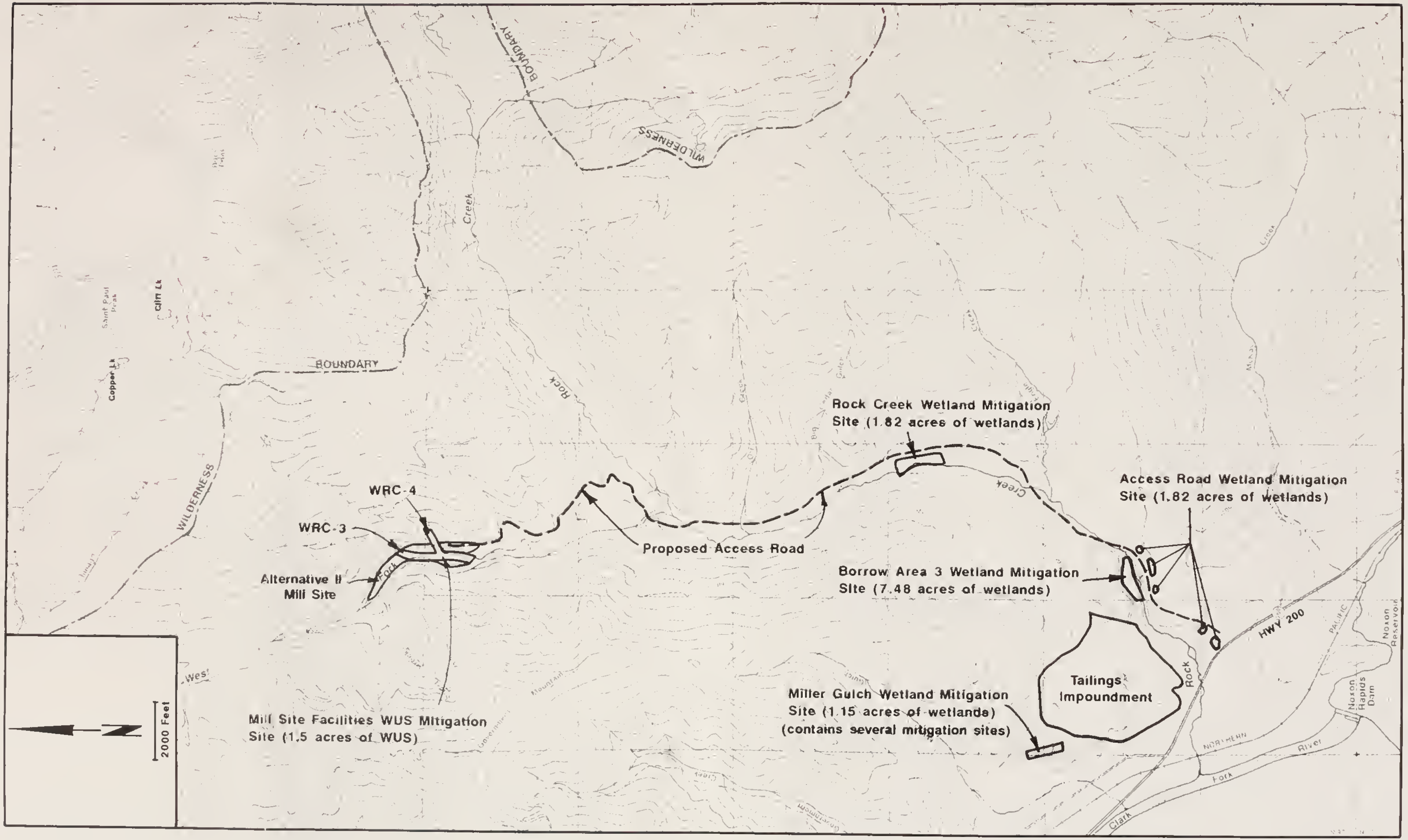
Wetlands Mitigation Plan. ASARCO completed the identification and delineation of Waters of the U.S. and associated wetlands for the study area. The inventory encompassed areas proposed to be disturbed by the tailings impoundment, mine entry and access roads, mill site, exploration/ventilation adit, and most of the alternative areas included in this EIS. Based on the delineation, the proposed project would affect approximately 1.5 acres of Waters of the U.S. and 8.1 acres of wetlands (see **Table 2-4**). Waters of the U.S. and wetland resources are described in detail in chapters 3 and 4.

TABLE 2-4.
Affected Acreage of Wetlands and Waters of the U.S by Mining Alternatives

	Affected Acreage[1] (Direct and Indirect)		
Mining Alternative	Wetlands	Waters of the U.S.	Total Acres
Alternative II - ASARCO Proposed Project	8.1	1.5	9.6
Alternative III - Proposed Project with modifications and mitigations	6.2	1.5	7.7
Alternative IV - Modified Rock Creek Project with mitigations	6.0	0.4	6.4

Source: ASARCO, Incorporated 1993.

[1] Additional field surveys will be performed for alternative FDR No. 150 alignment and the Miller Gulch rail load-out during 1995.


BOUNDARY
WILDERNESS
BOUNDARY
WILDERNESS
Creek
Rock
Cliff Lk
Copper Lk
Saint Paul Peak
Rock Creek Wetland Mitigation Site (1.82 acres of wetlands)
Creek
Access Road Wetland Mitigation Site (1.82 acres of wetlands)
WRC-4
WRC-3
Alternative II Mill Site
Fork
Proposed Access Road
Borrow Area 3 Wetland Mitigation Site (7.48 acres of wetlands)
HWY 200
Noxon Reservoir
Tailings Impoundment
Rock
Noxon Rapids Dam
Miller Gulch Wetland Mitigation Site (1.15 acres of wetlands) (contains several mitigation sites)
Mill Site Facilities WUS Mitigation Site (1.5 acres of WUS)
West
N
2000 Feet
NORTHERN
PACIFIC
River
Fork
Clark

NOTE: WUS = Waters of the U.S.

FIGURE 2-22
Waters of the U.S. and Mitigation Sites
Rock Creek Project

ASARCO prepared a Wetland Mitigation Plan (ASARCO, Incorporated 1993) in compliance with Section 404(b)(1) of the Clean Water Act. The mitigation plan provides for the mitigation of and compensation for the unavoidable loss and potential diminishment of the wetland functions and values associated with development of the proposed project. In the mitigation plan, ASARCO proposes to create 12.3 acres of wetlands on site to compensate for the loss of about 8.1 acres of wetlands (see **Table 2-5**). Approximately 1.5 acres of Waters of the U.S. (primarily without vegetated wetlands) would be affected by the project. The proposed mitigation would create about 1.5 acres of Waters of the U.S. on site at the end of the project.

TABLE 2-5.
Proposed Acreage and Schedule for Created Wetlands and Reconstructed Waters of the U.S.

WETLAND MITIGATION SITES	CREATED ACREAGE		SCHEDULE
	WETLANDS	WATERS OF THE U.S.	PROJECT YEAR
ASARCO mill site area		1.5	30
Borrow area 3	7.5		4 - 5
Access road sites	1.8		1
Miller Gulch sites	1.2		1 - 2
Rock Creek sites	1.8		1
TOTAL WETLAND MITIGATION	12.3	1.5	1 - 30

ASARCO identified four possible wetland mitigation areas and one Waters of the U.S. mitigation site (see **Figure 2-22**) near the potentially impacted sites. Mitigation areas on **Figure 2-22** encompass larger general locations which included the smaller actual mitigation sites. The proposed acreages and mitigation schedules for the created wetlands and Waters of the U.S. are provided in **Table 2-5**. Mitigation of the Waters of the U.S. would be accomplished by reconstructing the intermittent channel at its premine location during final reclamation of the mill site. ASARCO's selection of the mitigation areas was based on:

- suitability for establishing similar functions and values;
- proximity to the project area;
- surface ownership;
- cumulative acreage of sites to achieve a minimum of one-for-one replacement; and
- relative cost of mitigation.

Detailed descriptions, including site development, design specifications, and schedules are presented in ASARCO's Wetland Mitigation Plan (ASARCO, Incorporated 1993). Most of the proposed wetland creation sites would be constructed during early mine construction, prior to destruction of the existing wetlands. The schedule would allow for some of the created wetlands to establish functions and values similar to the existing wetland resources and provide the opportunity to regrade, reseed, or redesign wetland mitigation sites if the first attempts were unsuccessful.

Surface runoff from undisturbed hillsides above the mill facilities and patio area would be diverted around the mill site and discharged to the natural channel of WRC-3 below the mill facilities area (see **Figure 2-21**). The diversion ditches at drainages WRC-3 and WRC-4, and unnamed tributaries to West Fork Rock Creek would be designed to handle the 100-year rainfall-on-snow event. Following the end of mining and processing activities, all diversion ditches would be removed and the areas reclaimed to their approximate original topography. Drainages WRC-3 and WRC-4 would be returned as closely as possible to their original configurations and functions.

The borrow area 3 mitigation site would be developed into a wetland by excavating borrow material (using scrapers or a truck and shovel operation) to lower the surface elevation of the site to near that of the Rock Creek overflow channels. Excavation work would involve the construction of a series of channels with intervening ridges. Channels would be 1 to 2 feet below the ridges and would have a very low gradient (0.1 percent) sloping to the west. A buffer zone of undisturbed ground between the mitigation site and Rock Creek would be retained along the south edge of the borrow area and would be stabilized, if necessary. This site is located beyond the 100-year floodplain and away from overflow channels.

Wetland hydrology for the borrow area 3 wetland would be established by excavating the channels to a depth which allows saturation and inundation of the area by seasonally high ground water. Monitoring wells or test pits would be constructed within the borrow area prior to final design to determine ground water levels and necessary depths of excavations to provide the proper wetland hydrology.

Soils on this site would be salvaged to a depth of about 13 inches. The soil would be redistributed over the mitigation site and disced or harrowed to prepare a seedbed. If available, hydric soil from the wetlands proposed to be impacted by the tailings impoundment could be salvaged and respread in the channels to increase the soil organic matter and provide a source of native plant material (soil seed bank and root sprigs). The channels would be seeded and planted with a shrub wetland mixture and the ridges with a forested/wetland mixture. One ton per acre of straw mulch would be evenly spread and crimped onto the disturbed areas. The primary functions of the created borrow area 3 wetlands would be to reduce sediment transport to Rock Creek and increase habitat diversity for wildlife and aquatic species.

Five small wetland sites would be created by the construction of a new segment of FDR No. 150. The access road wetland mitigation sites would occur where the new segment of road would cross small drainages, resulting in temporary water retention on the uphill side of the road or along the borrow ditch. Some existing wetlands, to be impacted by the access road upgrade, have been created artificially by construction of FDR No. 150. This new segment of the proposed access road crosses relatively flat terrain with several broad swales. Establishing the wetland hydrology would rely on the capture of seasonal runoff and temporary retention of water on low permeability, poorly-drained soils. ASARCO estimates these mitigation wetlands would be fully inundated to an average depth of 1 foot for 3 to 4 months during snowmelt runoff (March through May or June) and partially inundated or saturated through July and August.

FDR No. 150 wetland sites would be created on the uphill side of the road by raising culverts above the base of the fill, or by using standpipes. Soil salvage details would be developed during final design based on individual site soils. A clay sealant or polyvinyl chloride (PVC) liner would be considered if the hydraulic conductivity of the soil and substrate was greater than 2.8×10^{-4} feet per day (ft/day)[5]. Following grading or sealant installation, salvaged soils would be respread and a seedbed prepared. The sites would be seeded with a herbaceous wetland mixture and straw mulch applied. The primary wetland functions of the proposed access road created wetlands would be to reduce sediment transport to Rock Creek and increase habitat diversity for wildlife.

The Miller Gulch wetland mitigation sites would consist of a series of linear wetlands created along a side drainage to the main tributary of Miller Gulch. This side drainage currently does not contain wetlands but may be similar in size to other nearby drainages that do support wetlands. Establishment of wetland hydrology in the side drainage would rely on flow barriers designed to retain surface water runoff and thus increase the duration of saturation and inundation. These mitigation wetlands likely would be inundated during similar periods of the year as those created along FDR No. 150.

Small retention dikes would be constructed at approximately 200-foot intervals along the full length of the side drainage of Miller Gulch. The dikes would be 30 to 50 feet long and a maximum of 5 feet high. Each dike would contain a rock-lined spillway. If the saturated hydraulic conductivity of the soil and substrate was greater than 2.8×10^{-4} ft/day, a clay sealant or PVC liner would be used. Hydric soils from the impacted wetland areas of Miller Gulch would be salvaged and directly respread on the mitigation sites to provide increased organic matter and a plant materials source. The sites would be broadcast seeded with a forested wetland mixture and trees and shrubs planted (ASARCO, Incorporated 1993). Straw mulch would be applied. The primary wetland functions of the proposed Miller Gulch created wetlands would be to reduce sediment transport, increase aquatic and terrestrial habitat diversity and abundance, and attenuate peak flows.

The proposed Rock Creek wetland mitigation sites would consist of four linear wetlands created adjacent to Rock Creek by excavating to a depth which would allow saturation or inundation of the areas by shallow ground water. Depth to ground water (PW-6) in the mitigation area is less than 6 feet. Additional test pits would be placed in the wetland mitigation areas prior to final wetland design in order to verify ground water levels. Linear channels would be excavated with bottom widths varying from 10 to 25 feet to create a more natural configuration. Benches and shallow depressions would be constructed along the longitudinal profile to increase water retention and create zones with variable saturation and inundation. Benches would be saturated or inundated only during spring; however, the channel bottoms would remain saturated later into the growing season (ASARCO, Incorporated 1993). The shallow depressions would be inundated or saturated for the majority of the growing season.

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[5] For comparison, the average hydraulic conductivity of clean sand is about 28.4 ft/day; 100,000 times faster than the hydraulic conductivity rate that would trigger use of a liner.

Soil salvaged from the proposed Rock Creek wetland mitigation areas would be respread on all disturbed surfaces. Respread soils would be disced or harrowed to provide a proper seedbed. Linear channels would be seeded with a herbaceous wetland mixture and the sideslopes with a upland herbaceous mix. All sites would be mulched. Wetland functions of the proposed Rock Creek constructed wetlands would be to enhance ground water recharge and discharge and increase aquatic and wildlife habitat diversity and abundance.

Alternative III -- Proposed Project with Modifications and Mitigations

Alternative III incorporates modifications and mitigating measures proposed by the Agencies to reduce or eliminate undesirable environmental impacts (see **Figure 2-23**). These measures are in addition to or instead of the mitigations proposed by ASARCO. Proposed modifications have been developed in response to the significant issues identified during the scoping process.

Table 2-6 indicates the significant issues pertinent to this project and indicates which of the following sections address modifications and mitigation measures for those issues. All other aspects of ASARCO's mine proposal would remain as described in Alternative II. Chapter 4 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

TABLE 2-6.
Alternative III Modifications and Mitigations

	Sections							
Significant Issues	Mine Plan	Ore Shipping & Transportation*	Tailings Impound -ment	Water Use & Management	Utilities	Socio-economics	Reclamation	Monitoring & Mitigation Plans
Surface & Ground Water Quality	x	x	x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x			x		x	x
Impoundment Stability			x					
Socioeconomics								
Old Growth Ecosystems	x	x			x			
Waters of the U.S. and Wetlands								x
Public Access/ Traffic Safety		x						
Aesthetic Qualities	x	x	x		x		x	

*This column combines two sections discussed separately below.

Fold Out

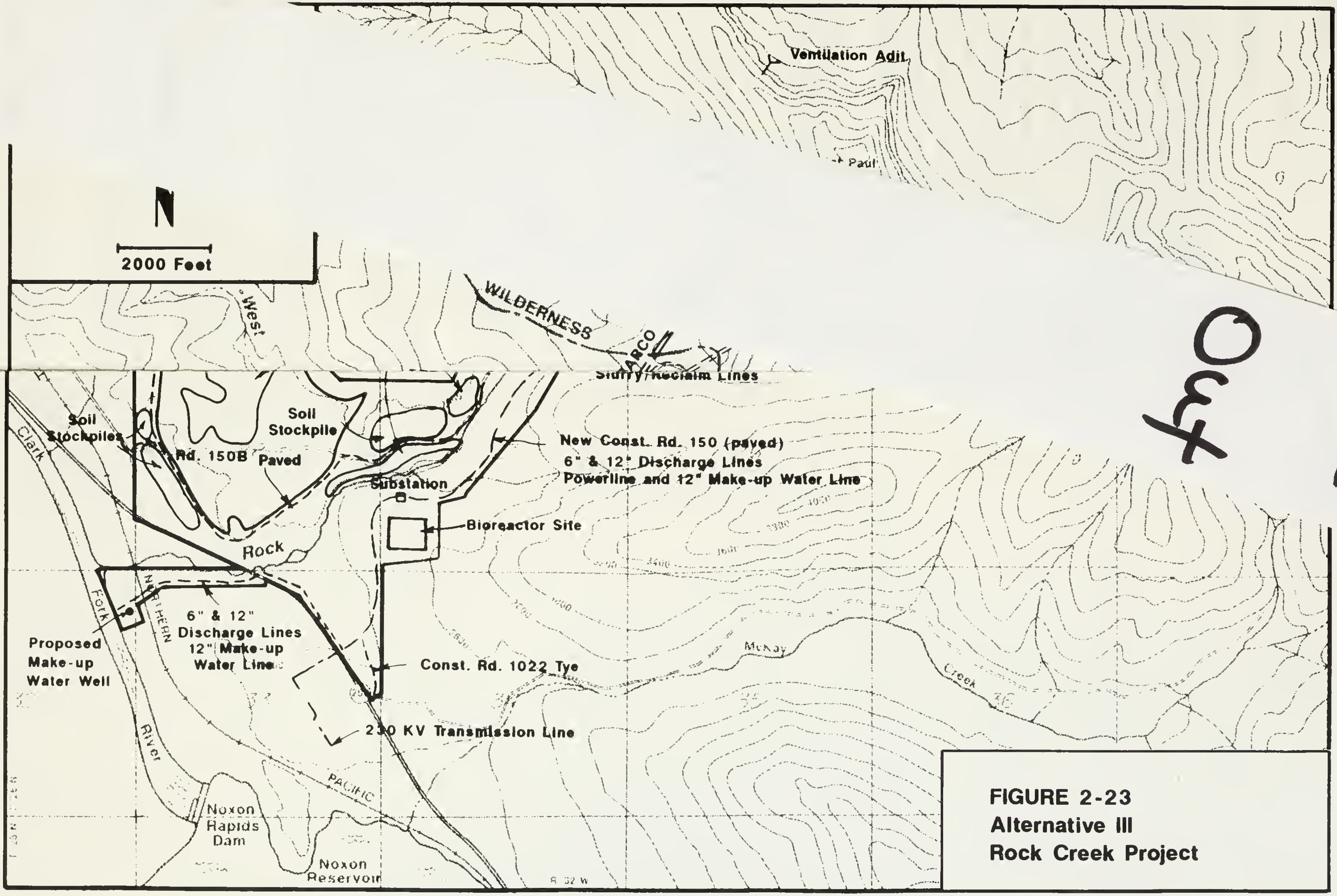

FIGURE 2-23
Alternative III
Rock Creek Project

Mine Plan

Under Alternative III, ASARCO would be required to provide for Agency review and approval an updated preliminary mine design prior to exploration and mine start-up. The Agencies would conduct a second review of the mine design to determine its suitability for actual conditions during mine adit construction. Specifics of this review would focus on general design approach, design criteria and methodology, rock mechanics test data from the Rock Creek deposit[6], proposed room-and-pillar sizing and layout, identification of zones of rock instability and potential subsidence, and mitigations for these areas. Given the expected changes in planning any underground mine development, ASARCO would submit updated detailed mine plans for Agency review prior to entering areas where mining could have deleterious impacts if adequate precautions were not taken. This would ensure development was meeting the environmental objectives and intentions of the original design. Approval of the mine plan would be contingent on demonstrating that Copper and Cliff lakes would be unaffected by mining, and that the potential for subsidence would be minimized, based on hydrogeologic and applicable engineering analyses.

Aesthetic impacts of the mill and mine-related facilities would be minimized because ASARCO would be required to conduct the following mitigations:

- plant or retain a vegetative buffer of sufficient width between FDR No. 150 and the exploration adit support facilities, the passive biotreatment facility, and the substation in the lower Rock Creek drainage for visual screening;
- treat and/or paint permanent (life-of-mine) structures within the project area to visually blend with the surrounding landscape;
- shield or baffle exterior exploration adit lights from viewpoints in the Clark Fork Valley;
- deposit waste rock in two dumps on hillsides adjacent to the mine adits in existing clearcuts (see **Figure 2-23**). Adjacent vegetation would be retained the extent possible;
- retain or plant trees to screen the northeast hillsides above the mill, and operate all surface and mill equipment so that sound levels do not exceed 55 dBA measured 250 feet from the mill;
- replace above-ground vehicle back-up beepers with discriminating back-up alarms that sense movement behind a vehicle; and
- adjust intake and exhaust ventilation fans in the exploration and mine adits so that they generated less than 82 dBA measured 50 feet downwind.

ASARCO would have two ventilation adits; the exploration adit for ventilation during the operation phase and the proposed ventilation adit in the wilderness near year 20 (if necessary to meet

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[6] Rock mechanics data would be obtained during construction of the exploration adit.

MSHA standards). A process would be developed to ensure locating a ventilation adit in the CMW would be the last choice among potential ventilation options. If it was deemed necessary to construct the ventilation adit in the CMW, ASARCO would conduct a study verified by a site visit with the Agencies prior to excavation to evaluate variations in topography and rock formations. For purposes of analysis in this EIS, the Agencies have assumed that the ventilation adit would be relocated about 400 feet north of the west ridge of Saint Paul Peak and would disturb about 800 square feet. The wilderness ventilation adit would be located so as to minimize visual impacts and reduce noise impacts to 45 dBA (measured 50 feet from the ventilation portal). If necessary to achieve this level, specially designed low-noise fan blades or active noise-suppression equipment would be used.

ASARCO would install the portion of temporary pipeline between the exploration adit and FDR No. 150 with a cable and winch instead of dragging it through the woods with a tractor. This would minimize vegetation clearing and erosion on the steep hillside below the exploration adit.

Surface Disturbance

A total of about 608 acres will be disturbed within the permit area for alternative III (see **Table 2-1**). The Forest Plan would be amended to make management area allocations on 330 acres consistent with the intended use.

Ore Shipping

The rail load-out would be located to the south of Miller Gulch, west of the tailings impoundment and just north of Montana Highway 200, along Montana Rail Link's mainline. The concentrate would be hauled to the load-out via FDR No. 150 to FDR No. 150B around the impoundment and then to Government Mountain Road. This would eliminate ore truck traffic on the highway and would locate the load-out away from houses (see **Figure 2-23**).

Tailings Impoundment

Impoundment Construction. ASARCO offered an alternative tailings impoundment design to address the stability issues of resistance to seismic liquefaction, phreatic surface control, and soft foundation conditions (Dames & Moore 1993). This tailings impoundment would be raised using a combination of the centerline and upstream methods known as the modified centerline method (see **Figure 2-3**). For the first 7 years, the impoundment would be constructed using the centerline technique followed by the upstream method for the remainder of the facility life. The alternative design would also include compacting the tailings beach to the density required to resist liquefaction, possible removal of soft clay underlying portions of the dam, and a concrete shear-wall to improve sliding stability under one of the starter dams. The impoundment was designed to withstand a 7.0 magnitude earthquake occurring on the Bull Lake Fault. This design is described in *Revised Alternative Impoundment Design* (Dames & Moore 1993) and is discussed in **Appendix E**.

ASARCO would use some waste rock from mine adit construction for the starter dams and foundation materials. This would eliminate the need for developing borrow area 2 if volume from borrow areas 1 and 3 and waste rock that could be economically transported was sufficient.

The tailings impoundment design would be finalized as additional site information was obtained from the final design investigation process. Technical review of the final design would be made by a review panel established by the Agencies.

The panel would be charged with reviewing the final design for the tailings impoundment as developed by ASARCO, offering critical comments and suggestions. Review would encompass the technical aspects of design including the short- and long-term stability of the embankment. The panel would ensure that any environmental impacts associated with final design remained within the scope of those impacts identified in the final EIS. If the final design generated additional impacts and they could not be mitigated to remain within this scope, then further MEPA/NEPA documentation would be required. The Agencies would review and approve the final design prior to construction.

Embankment Drainage. Impoundment drainage in Alternative III would be controlled in part by the 200-foot-wide shell of free-draining sand placed on the outside of the embankment. This would maintain the pond no closer than 400 horizontal feet from the dam crest. There would be no need for blanket drains on the starter dams as in the proposed alternative because of the modified centerline design. The intercepted water would be collected and returned to the impoundment via seepage collection trenches and ground water capture wells.

If preliminary rock and tailings characterization data suggest that these materials would contribute to acid rock drainage, alternative seepage preventative measures such as lining the impoundment with a seepage-inhibiting layer or material would be investigated. The results of this study would be incorporated into the Final impoundment design to be reviewed by the technical panel.

Tailings Impoundment Seepage. If suitable, clay material excavated at the location of the proposed tailings impoundment embankment would be used to seal (line) the colluvium (soil deposited by gravity) at the north end of the proposed tailings impoundment, and other areas of the impoundment footprint that would be underlain by materials of higher permeability. Clay also could be stored, if necessary, based on acid base accounting during exploration, for use at a later date to help reclaim waste rock piles.

Water Use and Management

A detailed water balance would be refined annually for estimating water use, seepage, and discharges. Actual volumes for a number of water balance variables would be measured to update previously projected calculations. These would include measurements of precipitation; evaporation; mine and adit inflow, outflow, and storage; inflow to the tailings impoundment; seepage from the tailings impoundment; seepage collected by the perimeter recovery system; outflow to the passive biotreatment system; and discharge to the Clark Fork River.

The potential for acid drainage cannot be conclusively determined from baseline data but is not expected, based on conditions at the ASARCO Troy Mine. Additional data collected during exploration, mine development, and operations would be required to predict the potential for long-term acid drainage, and to assess the acid drainage potential of waste rock prior to its use as construction material. A representative underground sampling and acid-base testing and monitoring program would be developed and implemented on rock from the adits, ore zones, above and below the ore zones, and in the barren zone. The results would help identify materials to be segregated to prevent production of acid leachate or drainage.

The Agencies would require long-term monitoring, maintenance, and possible long term post-closure water treatment in order to assure ground and surface waters would be protected from unanticipated impacts.

Transportation

ASARCO must submit a traffic management plan to reduce total average daily traffic (ADT) to the mill site. This plan would address both construction and operation mine-related traffic (excluding public recreation, Forest Service, and logging traffic).

The intersection of FDR No. 150 and Montana Highway 200 would be relocated to meeting applicable MDT siting requirements. The alternate route for FDR No. 150 (see **figures 2-18 and 2-23**) would intersect Montana Highway 200 about 1,200 feet west of FDR No. 1022 (McKay Creek Road). This route would then proceed westerly and northerly over NFS lands and ASARCO land to tie back into FDR No. 150 just north of the Engle Creek Road intersection. This alternate road would need to be constructed prior to closure of existing FDR No. 150 near the tailings dam area. ASARCO would time its road closure schedule for FDR No. 150 to accommodate essential local access needs.

ASARCO would reroute access to the mine portal to minimize or eliminate slumping potential of the hillside at ASARCO's proposed location and to reduce impacts to old growth habitat. Access to the portal would be via FDR No. 150, FDR No. 2741, and an existing nonnumbered spur road (see **Figure 2-19**). Specifications of the road would be as follows:

- FDR No. 150 (14-foot-wide dirt road) from north of the mill site to the junction of FDR No. 2741 (about 1,000 feet) would be reconstructed to a two-lane 24-foot-wide gravel road.

- FDR No. 2741 and nonnumbered spur road (14-foot-wide dirt road) from the junction of FDR No. 150 to the portal site (about 6,600 feet distance) would be reconstructed to a two-lane 24-foot-wide gravel road.

A travel lane would need to be maintained for traffic on FDR No. 150 during road construction and reconstruction. ASARCO would need to develop a traffic plan to allow private landowners reasonable access to their property, and public access to NFS lands. In addition, emergency medical access to the mill and mine sites would need to be considered in the plan.

Utilities

ASARCO would use a single utility corridor along FDR No. 150 for all pipelines and for the proposed 230 kV powerline. This would reduce impacts to threatened and endangered species, old growth habitat, and water quality.

ASARCO would construct 6.8 miles of 230 kV transmission line with wood pole, dark porcelain or polymer insulators, and nonspecular conductors to reduce contrast. From Montana Highway 200, the powerline would parallel new FDR No. 150 until it intersected existing FDR No. 150. It would continue parallel to FDR No. 150 to the mill site except for a cross-country segment above the confluence of the East and West forks of Rock Creek.

ASARCO would use the following measures to reduce right-of way clearing and help produce a feathered, more natural-appearing edge of timber along the utility and road corridor. These measures would be applied to appropriate segments of the corridor during the design phase:

- retaining non-hazardous trees and brush on the right-of-way;
- cutting trees at ground level to reduce visibility of stumps;
- disposing of felled material with the least possible impact on remaining vegetation; and
- selective clearing of timber adjacent to the corridor to soften the edge between cleared and uncleared areas.

Erosion and Sediment Control

In addition to the BMPs proposed by ASARCO, a vegetation management plan would be developed to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments.

Reclamation

Postmining Topography. Regrading plans for each facility would need to be developed by ASARCO to reduce visual impacts of reclaimed mine facilities. All of these plans which are described below would require Agency review and approval prior to implementation.

ASARCO would develop a plan to restore the ventilation adit within the CMW to its premining appearance and configuration following mine closure. Rock from adjacent areas and/or waste rock treated with oxidating compounds would be used for the surface closure to replicate natural conditions and appearances.

ASARCO would regrade the exploration adit waste rock dump to approximate existing contours at the end of operations, eliminating any bench at the adit portal. Waste rock from the lower Revett treated with oxidating compounds would be used for the surface closure to replicate natural conditions and appearances.

ASARCO would regrade the exploration adit waste rock dump to approximate existing contours at the end of operations, eliminating any bench at the adit portal. Waste rock from the lower Revett Formation[7], a rock formation with similar characteristics to surface rock, would be used for the surface layer of the dump, especially for the portion that would be left unvegetated. If necessary to meet visual quality objectives, waste rock surfaces that remained exposed after reclamation would be treated with oxidating compounds to blend them with adjacent talus. Where possible, existing trees at the outer edge of this talus slope and existing pockets of trees and shrubs within this talus slope would be retained and would not be damaged during dumping.

ASARCO would develop a design, with approval by the Agencies, to recontour faces of the tailings impoundment to more closely blend with the surrounding landscape. This design would incorporate additional fill at selected intersection points of the impoundment and adjacent landforms, use of waste rock in selected locations to create a coarser surface texture, and use of benches in some locations to facilitate tree and shrub plantings. To the extent possible, the linear edges, horizontal crest, and uniformly sloping faces of the impoundment would be recontoured into a series of undulating forms that blended into the surrounding landscape. Whenever possible, these features would be developed during impoundment construction to reduce the amount of regrading during reclamation.

ASARCO would develop plans to shape slopes of the mill site, waste rock dumps, and mine portal areas to more closely resemble the surrounding landscape. A portion of this would be achieved during construction of the mill site and waste rock dumps. The remainder of the work would be done during the reclamation phase and would involve regrading and shaping flat surfaces to blend with the adjacent landscape. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms. If necessary to meet visual quality objectives, rock surfaces that remained exposed after reclamation would be treated with oxidating compounds to blend them with adjacent talus.

Soil Salvage and Handling Plan. Soil salvage and handling methods would be similar to ASARCO's project and exploration adit proposals (Alternative II). Soil volumes are different due to changes in road and utility locations (see **figures 2-18 and 2-23**) and deeper soil salvage. The expanded soil salvage and handling plan would include means to ensure that handling losses were minimized and that direct-haul methods were maximized. Also, the timing and sequencing of stockpile use (for respread) would be detailed to ensure that visual impacts would be mitigated (see Scenic Resources, Chapter 4).

Soil stockpiles would be incrementally stabilized (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. All interim seeding would be done as soon after disturbance as possible rather than waiting until the next appropriate season. Immediate seeding of road cuts-and-fills has reduced erosion on Forest Service roads regardless of planting time (Lou Kuennen 1990, Kootenai National Forest, personal communication, February 20, 1990). Sediment traps would be used downslope where necessary to minimize soil movement.

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[7] This rock type would be the last waste rock removed from the exploration adit.

To enhance tailings impoundment reclamation, soils would be salvaged from the tailings impoundment area in two lifts. The first lift would be the more suitable topsoil as proposed by ASARCO. In addition, a second lift would be excavated up to 36 inches; this would be respread over the prepared impoundment surface first. Beach materials (sandy tailings) that would accumulate at the edge of the impoundment could be respread over the slimes before soil distribution and planting preparation. Replaced soil depths would average 24 inches over the tailings impoundment.

ASARCO would use soil from the stockpile located southwest of the impoundment (S-1) for reclamation activities before using S-2 (east of the impoundment, see **figures 2-13 and 2-23**). After S-1 was depleted, this area would undergo final revegetation with shrubs and trees for visual screening from Montana Highway 200.

Recontouring of the impoundment dam face (see Postmining Topography) also would allow additional soil to be placed where slopes were less than 30 percent. Again, this would provide variability to the new soils, thus enhancing establishment of planted species and aiding in reintroduction of and colonization by native species.

Topsoil salvaged mainly from the mill site would be respread over all of the facilities areas because little soil is available in the waste rock dump and portal areas. DSL requires salvage of rocky soil (less than 50 percent rock fragments 3 inches or less) if it is characteristic of the area (Pat Plantenberg, Department of State Lands, personal communication, July 19, 1994). ASARCO would use the two-lift approach for the mill site area where soils are generally deep, and would salvage soils deeper (to 36 inches) than proposed in Alternative II. Soils would also be salvaged at the portal and waste rock site where they are shallower and rocky. Soils replacement depths would range from 0-24 inches in the mine portal and waste rock dump areas.

Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches prior to seeding for best seed establishment. Where soil fertility may be low and tilth poor, organic matter (weed-free aged manure, compost) would be incorporated into respread soils before planting.

Where possible, slash from timber-clearing operations would be salvaged for soil protection. Large or whole pieces could be used as physical barriers and catchments and ground-up slash would be used as mulch or as an additive to stored topsoil. All mulching materials would be certified weed-seed free.

Revegetation. After year 7 of impoundment construction, ASARCO would apply a tackifier or hydromulch/seeding (with color additive) to each lift of the impoundment following construction and prior to final reclamation. This would reduce contrast of the sand tailings with the adjacent vegetation; hydromulching/seeding also would provide interim erosion control. Color of the additive would be subject to Agency approval.

ASARCO would develop a detailed final planting design for all disturbed areas including the area between the impoundment footprint and the highway. Final designs would avoid uniform distributions of plants, with planting densities, species selection, and their distributions repeating natural patterns in the surrounding landscape. A combination of planting designs, natural mortality, and possible thinning of thick tree stands would achieve a natural-appearing mosaic of vegetation on reclaimed areas. (Forest Service standards for revegetation would be required on NFS lands.)

ASARCO would develop a phased final reclamation and revegetation plan for faces of the tailings impoundment during the operational phase. Phased tree-planting, initiated before the end of operations, would allow the impoundment to blend with the surrounding landscape more quickly. The design for the impoundment faces would incorporate varying densities of shrubs and trees. Final design would be coordinated with grading and regrading plans and be implemented early to minimize redisturbance after revegetation. Tree planting could be started after year 7 when upslope construction began and would occur about every 2 to 4 years thereafter.

Trees would be planted adjacent to Montana Highway 200 soon after Agency permits were approved. This would facilitate earlier visual screening of the impoundment from the highway.

ASARCO would plant native shrub species at the exploration adit site. Earlier successional tree species such as larch, western white pine, and spruce would be planted. The grass seeding mix and talus component proposed for reclamation combined with these trees would better meet the needs of wildlife and visual resources. This modification to the seeding mix/planting rates would be subject to Agency approval. See **Appendix G** for suggested approaches.

Successful establishment and growth of trees are necessary to obtain the greatest visual mitigating effects on and adjacent to mine facilities. Given the importance of mycorrizhal fungi for tree growth and establishment, ASARCO would obtain locally grown tree seedlings from an appropriately inoculated soil medium. Legume species would be inoculated with appropriate nitrogen-fixing bacteria. Other methods such as transplanting native shrubs and/or very small trees could be proposed. Fertilizer requirements and planned fertilizer applications would be carefully calculated to minimize nutrient losses due to deep leaching.

Shade cards or other methods would be used to protect tree and shrub seedlings, especially on south- and west-facing slopes of the impoundment and mill site. New tree and shrub plantings would be protected from wildlife browsing by netting. Drip-irrigation would be used during April through early June for up to three years after planting trees and shrubs on the impoundment face to help with plant establishment.

Monitoring and Mitigation Plans

The following monitoring and mitigation plans would be coordinated to reduce conflicts and avoid duplicate requirements. They would be subject to Agency review and approval.

Rock Mechanics Monitoring. ASARCO would submit a separate surface and underground monitoring and testing plan once underground development had progressed enough to establish monitoring points. Its purpose would be to define the existing geologic stress field and its response to underground mining. The plan would specify monitoring equipment, locations, and frequency of monitoring and reporting, and define types of laboratory tests and frequency of testing. The information would be used in planning the size and location of underground openings and support pillars, identifying locations needing additional support and areas to be avoided for final mine development, and for making predictions about long-term behavior of the underground rock mass. Once mining was underway, ASARCO would be required to submit detailed mine development plans in advance of entering areas of suspected rock instability as identified in the preliminary design and during the underground monitoring program. These reviews could result in ASARCO leaving more in-place ore for support than was originally intended, or conversely the information could suggest areas where pillars could be removed without jeopardizing the long-term stability of the site.

Water Resources Monitoring Plan. ASARCO would submit a comprehensive long-term surface and ground water quality monitoring program (**see Appendix H**). Data collected from the monitoring program would be reviewed to evaluate the extent and magnitude of potential impacts during the proposed project's construction, operation, and postoperational periods. In conjunction with this plan, a Monitoring Alert Levels and Corrective Action Plan would be developed to ensure early detection of potential environmental degradation. The plan would identify alert levels, which when exceeded, would trigger a contingency or corrective action to be implemented.

Long-term postoperational surface water monitoring of streams and springs would continue until the Agencies determined that water quality met state standards. Sampling stations would be located primarily on the main stem and East and West forks of Rock Creek, Miller Gulch, and the Clark Fork River.

Long-term postoperational ground water monitoring would focus on tailings impoundment seepage and ground water quality inside and outside the permitted mixing zone. Monitoring wells associated with the proposed seepage interception system would provide data to evaluate the system's effectiveness. Additional monitoring and interception wells may be added if monitoring showed degradation outside the approved mixing zone. Adit and mine discharge and seepage through the waste rock dump and mill pad also would be monitored.

Monitoring of lake levels would occur at Cliff and Copper lakes because mining could cause fractures that may extend to the surface thereby affecting lake levels. If increased seepage was noticed in the mine workings, mining in the affected section would be halted and the problem investigated. The lakes would be visited and continuous lake level data would be retrieved and analyzed. During this period, additional grouting would be required. Upon further data analysis, more measures could be required to lower the seepage rate. A plan to mitigate impacts to wetlands potentially affected by draining of these lakes would be developed as part of ASARCO's wetlands mitigation plan.

Assuming adit portals could not or would not be permanently sealed, postoperational adit flow would be discharged to the Clark Fork River via the water treatment system until it met water quality standards. Then adit water would be discharged though a constructed permanent channel into the West Fork of Rock Creek. Monitoring would be continued according to MPDES requirements. ASARCO would investigate and fund alternative measures to assure adit plug stability and postoperational adit water treatment.

Wildlife Monitoring Program. ASARCO's fish and wildlife mitigation plan would be modified to incorporate the following measures:

- monitoring closed roads (Chicago Peak and Orr Creek roads) to determine if inappropriate use was occurring; and
- creating bat habitat in the exploration adit, if determined to be appropriate by the Agencies.

A wildlife monitoring plan would be developed to:

- coordinate with other programs to assess impacts to neotropical migrant birds;
- assess mountain goat population trends, habitat use, and responses to mine-related impacts in cooperation with DFWP; and
- assess sensitive species for population trends, habitat use, and responses to mine-related impacts in cooperation with KNF.

Aquatics and Fisheries Monitoring Plan. A conceptual monitoring plan is found in **Appendix H.** ASARCO would be required to monitor impacts to benthic macroinvertebrates, fish populations, and periphyton. Metals accumulations in fish tissues, and increases in sediment loads would also be monitored. Additional monitoring sites would be required. Monitoring for sediment sources during construction would be conducted under the reclamation monitoring plan found in **Appendix H.**

A mitigation plan would be required to address maintaining populations of sensitive fish species in Rock Creek (bull and westslope cutthroat trout) and to reduce sediment in spawning gravels. The plan would include a survey to identify sediment sources, and methods of reducing them both within and outside of the permit area, upstream of spawning areas, during or prior to mine construction. The survey and sediment reduction plan would include Rock Creek and the South and East forks of the Bull River.

ASARCO would be responsible for mitigating sediment sources within the Rock Creek watershed on NFS lands equivalent to 130 acres[8] Sediment source reduction activities wold be completed during the construction period, if possible.

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[8] This acreage is the sum of the amount of land associated with the tailings pond, the soil stockpile site, the access road, the tailings line corridor, emergency impoundments, and the exploration mine entry patio, and waste rock dump.

An unaltered vegetation zone would be left between Rock Creek and the road and utility corridors, where possible during new construction, to protect bull and westslope cutthroat trout habitat. Sediment catchment basins would be installed in road ditches in areas where fine sediments could be transported to streams from application of sand during winter. Mitigation plans for chemical spills and tailings pipeline rupture would be developed, prior to mine operation.

Threatened and Endangered Species Mitigation Plan. The following items would be required to reduce or eliminate consequences to species federally listed as threatened or endangered. A final mitigation plan would be developed and implemented by ASARCO and appropriate state and federal agencies (see **Appendix B**).

To reduce mortality risk to threatened and endangered species ASARCO would:

- not use salt when sanding during winter plowing operations to reduce big game mortality that could draw bald eagles, wolves, and grizzly (in spring) to the road corridor and increase mortality;
- remove road-killed animals daily from road rights-of-way within the permit area and along roadways used for access or hauling ore. Road kills would be moved at least 50 feet beyond the right-of-way clearing and further, if necessary, to be out of sight from the road;
- work with other mines operating in the area (e.g., Noranda) to partially fund a public information and education program to aid in grizzly bear conservation. This would be the same program as required in the RODs for the Montanore Project, not an additional one. The program would be funded for 5 years and then evaluated for need to continue or modify to better benefit grizzly;
- work with other mines operating in the area (e.g., Noranda) to partially fund a local DFWP law enforcement position for the life of the mine. This would be the same position as required in the RODs for the Montanore Project, not an additional one;
- bear-proof all project-related containers holding attractants and remove them in a timely manner;
- prohibit employees from feeding bears;
- develop a transportation plan to minimize mine-related vehicular traffic traveling between Montana Highway 200 and the mill site, and minimizing parking availability at the mill site.

To maintain habitat effectiveness for threatened and endangered species, ASARCO would:

- secure or protect (through conservation easement or acquisition) replacement habitat to compensate for acres lost by physical alterations; 3,011 replacement acres would be required; and
- work with private and corporate landowners within and adjacent to the Rock Creek drainage to close their roads to benefit grizzly bears.

To reduce mortality risk and maintain habitat effectiveness for threatened and endangered species, KNF would close 2.5 miles of FDR No. 2741 (Chicago Peak Road) and 2.0 miles of FDR No. 2285 (Orr Creek Road). ASARCO would construct a new trailhead with parking space for at least 5 passenger vehicles. Location would be at the new closure point of Chicago Peak Road.

Reclamation Monitoring Plan. More intensive monitoring would be required by DSL and KNF. A monitoring plan would address reclamation/soil stability during mine life as well as after closure. Since establishment of trees takes 5 to 7 years at a minimum, ASARCO would carry out a long-term monitoring program for up to 20 years after mine closure. Specific measures would include:

- monitoring soil salvage and replacement to verify depth and suitability;
- inspecting for erosion in spring and fall and after heavy rain and implementing immediate erosion-control measures, if necessary;
- monitoring construction activities to identify sources of erosion and to audit implementation of BMPs;
- conducting soil chemical tests to identify soil nutrient needs or toxicity problems prior to respread of soils and in areas of poor revegetation; and
- inspecting all seeded and planted areas annually during the active growing season to identify poor plant growth or damage and implementing remedial actions.

Wetlands Mitigation Plan. ASARCO would mitigate impacts to 6.2 acres of wetlands and 1.5 acres of Waters of the U.S. (see **Table 2-4**). Diversion of the 1.5 acres of Waters of the U.S. would be constructed so as to maintain premine functions and values. The proposed relocated segment of FDR No. 150 would directly affect ASARCO's proposed location of 1.8 acres of the "access road wetland mitigation sites". This relocated segment would not cross the small drainages and would not capture the seasonal runoff necessary to establish and maintain wetlands. The remaining 10.5 acres of wetlands mitigation sites proposed by ASARCO would still be available for use. Other locations within the riparian areas along Rock Creek and within the proposed permit area might have the necessary wetland hydrologic characteristics to replace FDR No. 150 mitigation site acres. ASARCO might be required to identify additional mitigation sites to comply with its 404 permit. A plan, required by COE as part of the 404 permit, would be developed to mitigate impacts to wetlands associated with Cliff and Copper lakes if subsidence should cause the lakes to drain. An aquatic life mitigation plan would be prepared in conjunction with the wetlands mitigation plan for wilderness lakes.

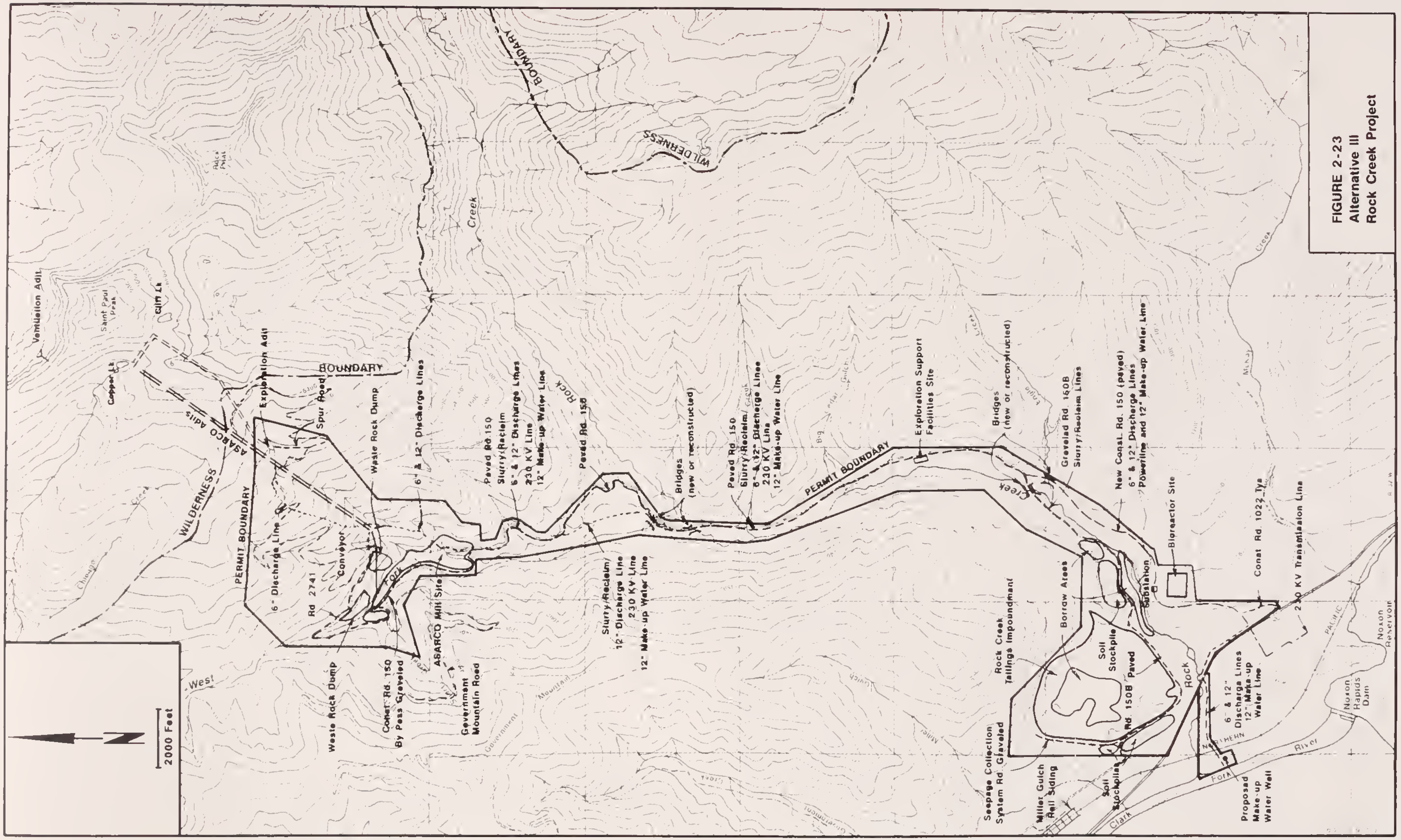


FIGURE 2-23
Alternative III
Rock Creek Project

A monitoring plan using standardized wetland assessment techniques for determining wetland functions and values would be performed to monitor impacts to wetlands and Waters of the U.S. during mining and to evaluate the success of re-establishing the functions and values at the wetlands mitigation sites.

Alternative IV -- Modified Rock Creek Project with Mitigations

The major modification distinguishing this alternative from alternatives II and III is the location of the portals and mill site at the confluence of the East and West forks of Rock Creek, about 1.5 miles closer to the Clark Fork Valley than alternatives II and III. This decreases the utility corridor length but increases adit length and the amount of waste rock produced (see **Figure 2-24**). **Table 2-7** lists the significant issues pertinent to this project and indicates which of the following sections addresses mitigating measures for those issues. Chapter 4 contains a more detailed discussion of how the mitigating measures would reduce or eliminate environmental impacts.

Alternative IV includes applicable modifications, mitigations, and monitoring plans from Alternative III as summarized below:

Modifications:

- Alternate impoundment design at the Rock Creek location
- Alternate rail load-out location near Miller Gulch
- Alternate location for wilderness ventilation adit

TABLE 2-7.
Alternative IV Modifications and Mitigations

	Categories						
Significant Issues	Mine Plan	Water Use & Management	Transportation	Utilities	Employment	Reclamation	Monitoring & Mitigation Plans
Surface & Ground Water Quality		x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x	x	x	x	x	x
Impoundment Stability							
Socioeconomics	x						
Old Growth Ecosystem	x						
Waters of the U.S. and Wetlands	x						x
Public Access/Traffic Safety			x				
Aesthetic Qualities	x					x	

- Combined utility and road corridor
- Relocation and reconstruction of FDR No. 150

Mitigations:

- Subsidence control and monitoring plan
- Rock mechanics and hydrogeologic sampling, testing and monitoring program to include an acid-base testing program
- Visual and sound mitigations for the mill site and ventilation and exploration adits
- Panel review of alternate impoundment design including feasibility of seepage reduction methods
- Use of mine waste rock for starter dam construction
- Use of excavated clays to seal more permeable areas within impoundment footprint
- Development of a transportation management plan
- Visual mitigations for the utility corridor
- Revised grading and revegetation plans for the mill and impoundment sites to mitigate visual impacts
- Deeper soil salvage and replacement depths to facilitate revegetation
- More detailed long-term reclamation monitoring plan than Alternative II
- More detailed aquatics/fisheries, wildlife, threatened and endangered species monitoring and mitigation plans than under Alternative II, including a sediment source reduction plan outside the permit area
- A comprehensive, long-term water monitoring plan which includes monitoring lake levels at Cliff and Copper lakes to be coordinated with subsidence control and monitoring plan and fisheries/aquatics monitoring plans
- An alert level and contingency/corrective action plan for each monitoring plan
- Maintenance and possible long-term post-closure water treatment
- Revisions to ASARCO's Wetlands Mitigation Plan

Mine Plan

The alternative mine/mill site, as shown on **figures 2-24 and 25,** would be located above the 10-foot flood stage (about 100-year flood event). It would be sited on cut-and-fill pads located at the toe of the southwest facing ridge at the confluence. The layout would afford a reasonably compact mill site arrangement. The relocation of the mine and mill site would reduce impacts to old growth habitat and wetlands in the West Fork of Rock Creek and would reduce sedimentation to surface waters.

The portal location would be placed at elevation 3,040 feet as shown in **Figure 2-24** and would be adjacent to the mill site. This location would place the portal 1,000 feet lower than the ASARCO proposal. Each of the adits would be about 6,500 feet longer than those proposed by ASARCO. This results in an approximate 67 percent increase in waste rock production, from 600,000 tons to 1 million tons. A tabulation of differences between the alternative mine/mill site and ASARCO's proposed location is provided in **Table 2-8.** The 1 million tons of waste rock would be used in part to construct the mill site pad, potentially raising the ground level at the mill site by a maximum of 50 feet. This maximum height would limit the mill site's visibility from Forest Service roads and wilderness viewpoints. Additional rock excavated from the adits beyond that needed to construct the pad would be used for foundation material and construction of starter dams at the impoundment. There would be no waste rock dump under this alternative.

TABLE 2-8.
Comparison of Mill Site Alternatives

Facility	Alternative II	Alternative IV	Difference for Alternative IV
Adit Elevation	4,100 ft.	3,040 ft.	Adit portal about 1,000 ft. lower
Adit Length	9,000 ft.	15,500 ft.	Each adit is 6,500 ft. longer
Adit Grade	+12.7%	+12%	0.7 % flatter
Waste Dump Tonnage	600,000 tons	1,000,000 tons	400,000 tons increase
Waste Dump Area	10 acres	included in mill site	10-acre decrease[1]
Mill Site Area	40 acres	47 acres	7-acre increase
Surface Conveyor Length	2,400 ft.	included in mill site	2,400 ft. decrease
Utility Corridor Length	36,150 ft.	29,000 ft.	7,200 ft. decrease
Road Upgrade Length	21.6 mi.	19.1 mi.	2.5 mi. decrease

[1] Waste rock used for construction of mill site area.

ASARCO would retain a minimum 100-foot vegetative buffer between FDR No. 150 and mine/mill facilities for visual screening except at the constructed overpass bridge for FDR No. 150 and at the mine adit access road (see **Figure 2-25**). Mill site surface disturbances would not occur within 300 feet of either fork of Rock Creek to provide a fisheries buffer. These buffers would help reduce sediment loading to Rock Creek and impacts to sensitive fish species and other aquatic life.

Surface Disturbance

A total of about 542 acres would be disturbed within the permit area under Alternative IV (see **Table 2-1**). The Forest Plan would be amended so that management allocations on 273 acres would be consistent with the intended use.

Water Use and Management

Water use and management would be substantially the same as in alternatives II and III except that one unnamed intermittent stream would have to be routed through or around the mill site.

Transportation

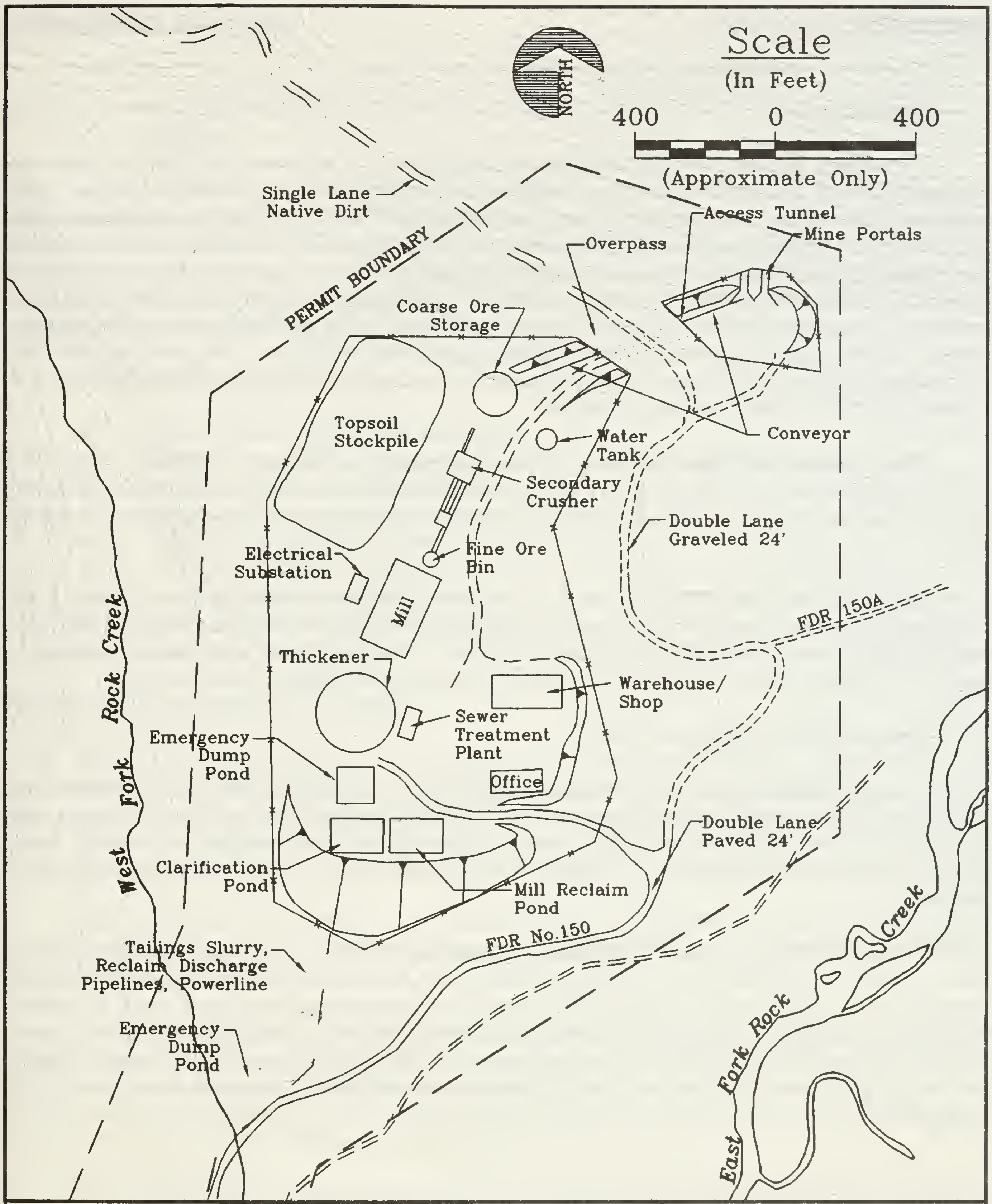
Due to the relocation of the mill site, the reconstruction of FDR No. 150 would be shortened by 2.5 miles. Mine and public traffic would share paved FDR No. 150 to the entrance of the mill site at which point ASARCO would reconstruct a 24-foot gravel road for a length of 1,900 feet to the intersections with the heavy equipment access road. The road would then taper to a single-lane and cross a newly constructed overpass of a gravel general access to the mine adit (see **figures 2-24 and 2-25**). Public and mine traffic conflicts would be reduced by routing most of the mine adit traffic under FDR No. 150 except for heavy equipment. The reduction in road length and subsequent construction/reconstruction activities would reduce the sources of new sediment loading to surface waters and lessens impacts to sensitive fish species and other aquatic life in the West Fork of Rock Creek.

Utilities

The utility corridor would be shortened by about 7,200 feet due to relocation of the mill site. The shorter utility corridor would reduce construction-related sediment impacts. There would also be fewer opportunities for potential spills from ruptured pipes in the Rock Creek Drainage; no pipelines, except the temporary water discharge line from the exploration adit, would be located in the West Fork of Rock Creek.

Employment

ASARCO submitted a revised employment schedule (Dave Young, ASARCO, Incorporated, personal communication, April 26, 1995) because the longer mine adits from the confluence mill site would increase the construction period. The revised schedule would limit the construction employment to about 350 workers for 1.5 years during years 4 and 5. Most mine development work (about 80 workers) would be done between exploration and mine construction. Employment would drop slightly during pre-production (approximately 180) before mine operation peaked at about 340 in year 7. This work force rescheduling would help reduce the boom/bust employment cycle.



Source: Hydrometrics, Inc. Drawing No. HEL-02195A03.DWG June 1995

FIGURE 2-25
Alternative IV Confluence Mill Site Layout Rock Creek Project

Reclamation

Postmining Topography. ASARCO would develop a design, subject to the Agencies' approval, to reshape faces of the confluence mill pad to more closely resemble the surrounding landscape. This design would incorporate small drainages, convex and concave forms, and varying slope gradients within swales that would repeat the surrounding landscape in form and shape. Pad faces would be graded concurrent with construction and revegetated immediately following pad completion, allowing the pad to blend with the surrounding landscape more quickly and reducing sedimentation to surface waters and impacts to sensitive fish species. The pad surface would be regraded and revegetated following mine closure. The overpass bridge would be removed and trench of the underpass (of the general mine access road) refilled and regraded to approximate original contour. Interim revegetation around buildings and roads would stabilize the site during operations.

Soil Salvaging and Handling Plan. Soil salvage depths would be similar to those in Alternative III. Soil volumes would be slightly different due to the deeper soils available at the confluence site and less road construction and reconstruction. Soil stockpile locations for the mill site are shown on **Figure 2-25**.

Revegetation. ASARCO would develop a detailed final planting plan for the mill site. Final revegetation of pad faces would occur as soon as the pad was completed. It would be seeded with grasses and forbs and planted with containerized shrubs and trees. Plantings would mimic natural patterns of vegetation. All other aspects of the planting plans would be as described in Alternative III.

Monitoring and Mitigation Plans

Threatened and Endangered Species Mitigation Plan. Nearly all aspects of the Threatened and Endangered Species Mitigation Plan proposed for Alternative III would be the same. However, the relocation of the mill site and the shorter transportation corridor would reduce the impacted acres; ASARCO would have to acquire 2,303 replacement or conservation easement acres as part of the mitigation.

Wetlands Mitigation Plan. Alternative IV would impact 6.0 acres of wetlands and 0.4 acres of Waters of the U.S. (see **Table 2-4**). Only 10.5 acres of wetlands mitigation sites proposed by ASARCO would still be available for use. Other locations within the riparian areas along Rock Creek and within the proposed permit area might have the necessary wetland hydrologic characteristics to replace the access road mitigation site acres. ASARCO might be required to identify additional mitigation sites to comply with its 404(b)(1) permit. Other components of the wetlands mitigation plan would be the same as for Alternative III.

PART III: ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER STUDY

A number of alternatives suggested during scoping have been determined by the Agencies to be infeasible or otherwise unreasonable. The alternatives discussed in this section were evaluated and have been dismissed from further consideration. The reasons for dismissal are described in the following sections. Agency evaluations used the Kootenai National Forest Plan (1987), the Kootenai National Forest's Mineral Coordination Activity Report (the MAC Report) (Kootenai National Forest 1986), and analyses conducted by ASARCO as part of the project planning process.

Dismissed alternatives fall under nine topics:

- mill and mine portal siting alternatives;
- tailings impoundment siting and construction methods alternatives;
- McKay Creek impoundment alternative;
- McKay Creek water retention dam;
- other tailings disposal methods, including backfilling;
- rail siding (load-out) alternatives;
- combined operations (Rock Creek and Montanore Projects)
- alternate water treatment methods; and
- socioeconomic alternatives.

Mill and Mine Portal Siting Alternatives

Initial investigations concerning mill and mine portal site alternatives were conducted by KNF and published in the 1986 MAC Report. The MAC Report recommended that the EIS evaluate in detail three mine portal and two mill site alternatives in combinations of sitings. These sites are identified as sites I, J, and K (see **Figure 2-1**). Site I is ASARCO's proposed mill site, Site J is on the ridge above the confluence of East and West forks of Rock Creek, and Site K is the confluence mill site.

Site I was used for the mill in alternatives II and III. Mill and portal site K was used in Alternative IV. According to ASARCO's baseline geology report, Site I was not a feasible portal location because the bedrock there was not suitable.

The two remaining siting alternatives recommended separating the mine portal locations from the mill site. The mill was located at Site K for both alternatives and was connected to a mine portal at either Site I or J by an ore conveyor and access road. Site I was not suitable for a mine portal as described above. Site J was considered, but was dismissed from further study because it was more visible from the wilderness and FDR No. 150 than alternatives III and IV.

The MAC Report also considered other mine portal and mill site alternatives but did not recommend them for further study. These include sites in the East Fork of Rock Creek and the Bull River drainage. The East Fork Rock Creek sites did not offer any advantages over other alternatives included in the EIS. The Bull River sites were not considered in detail because of distance from portal locations, grizzly bear habitat, and the relatively pristine nature of the potentially affected drainage.

Tailings Impoundment Siting and Construction Method Alternatives

Several tailings impoundment studies have been conducted for this general area. ASARCO conducted an impoundment site evaluation in 1984 prior to selecting the proposed site. The MAC Report also identified and evaluated a total of 21 potential tailings impoundment sites. U.S. Borax, and later Noranda, conducted impoundment studies in this area associated with Noranda's Montanore Project. The ID team examined these reports during preparation of this draft EIS. These analyses further evaluated alternative impoundment sites, impoundment construction methods, and tailings disposal methods. Results of these analyses are summarized below. (Refer to the analysis in **Appendix E** for a more detailed discussion.)

Construction Methods

Typically, there are two general types of retention dams used to contain mill tailings: (1) an earthen embankment constructed entirely with material other than tailings, and (2) an embankment consisting of some mixture of tailings and other earthen materials. The first general type of retention embankment is essentially similar to the type of dam used to impound a water reservoir and typically is used when the tailings require complete hydraulic isolation from the surrounding environment and/or the total amount of tailings is rather small. This kind of embankment is constructed prior to deposition of tailings and is built entirely with nontailings material. This type of impoundment construction was dismissed from further consideration because a large quantity of borrow material would be needed. Excavation of the borrow sites would result in several hundred acres of additional surface disturbance. The borrow would be expensive to excavate, transport, and place on the embankment.

The second general type of tailings retention embankment is constructed using the sand fraction of the tailings as a portion of the embankment construction material. The general construction sequence for this kind of tailings impoundment involves the construction of starter dams with nontailings material, much like the water reservoir dam discussed above. However, unlike a water reservoir dam, starter dams serve only to provide the beginning of the tailings embankment structure and are typically much smaller in both height and lateral extent than the final tailings impoundment.

This type of tailings retention structure is sequentially raised with stages of embankment construction rather than completely constructed prior to tailings deposition. Therefore, it is referred to as a staged embankment. Staged embankments are described by the direction the crest the embankment moves during construction; upstream, downstream, and centerline (see **Figure 2-3**). Additional detail on impoundment construction may be found in **Appendix E.**

The Agencies did not dismiss any staged embankment construction method. The type of impoundment construction did, however, play a role in the dismissal of impoundment sites as described in the next section.

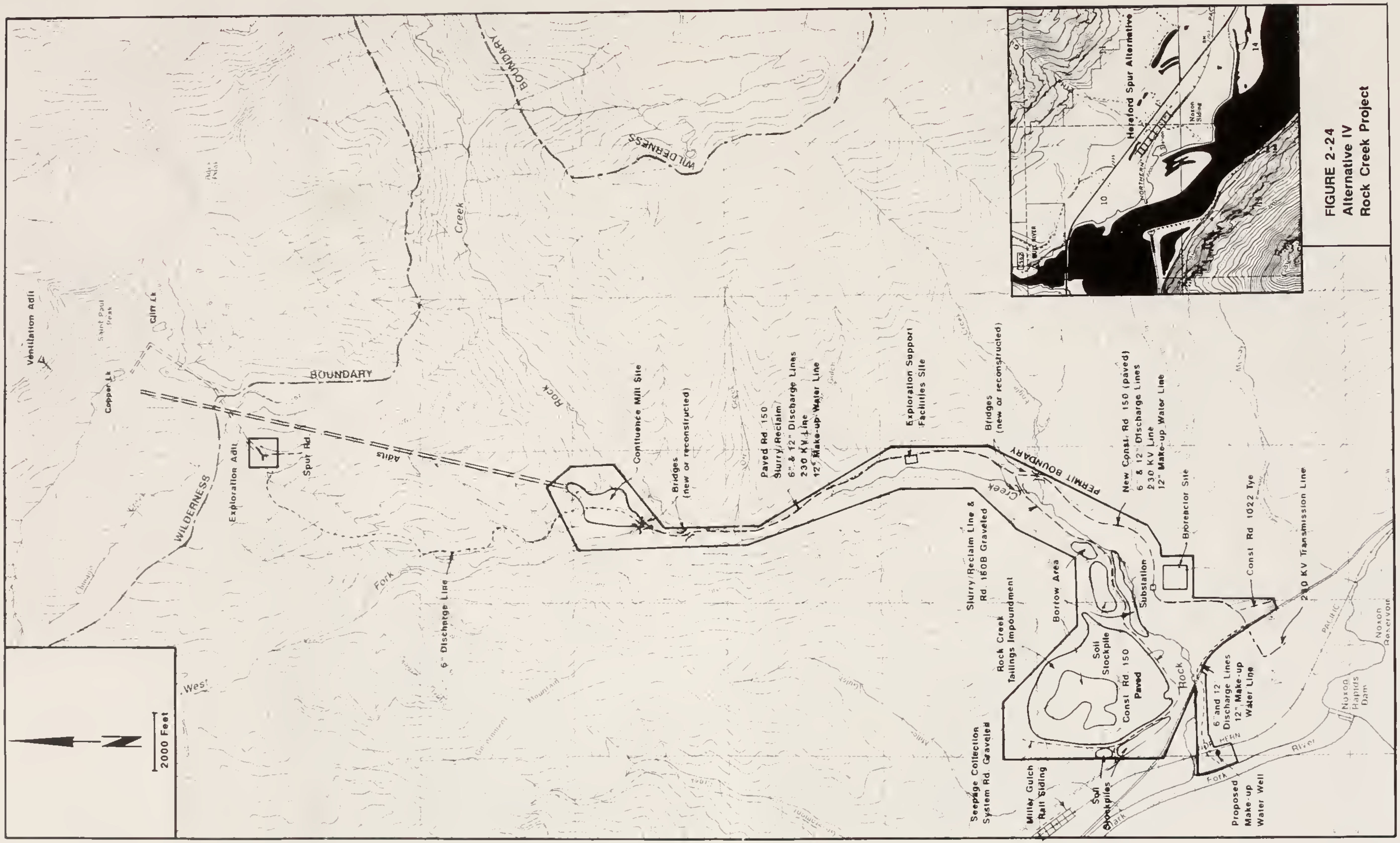


FIGURE 2-24
Alternative IV
Rock Creek Project

Alternative Impoundment Sites

The MAC Report (U.S. Forest Service 1986) identified four potential tailings disposal sites for a mine/mill complex located in the Rock Creek drainage. Further discussion of these four sites is included in **Appendix E** and Thompson 1989. Of these four sites, three were carried forward for further evaluation, they are: Rock Creek (MAC Report Site 11A), Swamp Creek (MAC Report Site 21), and Noxon Bench (MAC Report Site 10). The fourth site was eliminated because it was not large enough to handle the volume of tailings projected to be generated from mining the Rock Creek ore deposit. During the EIS process, the Agencies added the McKay Creek site to the three identified in the MAC Report, resulting in a total of four sites that were further evaluated as potential tailings impoundment locations. Agency evaluations combined both siting options and construction alternatives as well as using two impoundment sites concurrently. **Table 2-9** summarizes these evaluations.

McKay Creek Impoundment Alternative

The Agencies considered the McKay Creek site even though it did not meet previously mentioned selection criteria (see Issues and Development of Alternatives Process). This was because it seemed to be the most feasible impoundment siting that addressed the issues of tailings dam stability in terms of construction methods and retention of visual quality in the Clark Fork Valley near Noxon. As such, it was considered in substantially more detail than the other impoundment siting options dismissed in the previous section. Because this alternative did not have an engineered design and sufficient baseline data, the Agencies developed conceptual plans and assumptions about site conditions to guide their assessment of the environmental impacts (see **Appendix I** for more detail). A brief summary is included below.

Description

This alternative would have had similar components to Alternative IV except for the proposed tailings impoundment site. Powerlines, slurry and reclaim pipelines, and roads would have been longer than Alternative IV due to relocation of the impoundment (see **Figure 2-26**).

This conceptual alternative tailings impoundment site was located in the McKay Creek drainage, about 2 miles east of the mouth of Rock Creek. A dam using the downstream method of construction, approximately 1,500 feet wide and about 180 feet high, would have been placed across the mouth of the valley. The impoundment would have covered approximately 510 acres in the drainage and buried over 2 miles of McKay Creek. A major diversion of McKay Creek, 15,000 feet long and sized to channel the probable maximum flood (PMF) around the south side of the impoundment, would have been required during project operations. Once operations were completed and reclamation had begun, McKay Creek would have been diverted into an engineered streambed on top of the tailings impoundment. It would then have flowed over a concrete spillway and an energy dissipator and finally to a settling pond and the original streambed below.

TABLE 2-9.
Tailings Impoundment Siting Alternative Summary

Site	Construction Option	Reason Dismissed from Further Consideration	Reference
Rock Creek (MAC Report Site 12)	Not Applicable	Insufficient capacity	MAC Report (USFS 1986)
Rock Creek (MAC Report Site 11A, ASARCO proposed site)	Downstream Method	Excessive amount of borrow required (40 million cubic yards).	Thompson 1989
Noxon Bench (MAC Report Site 10)	Upstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River.	Thompson 1989
Noxon Bench (MAC Report Site 10)	Downstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River. Excessive amount of borrow required (35 million cubic yards).	Thompson 1989
Swamp Creek (MAC Report Site 21)	Upstream Method	Tailings & reclaim water pipelines twice as long as needed for the Rock Creek site. Disturbance area 200 acres larger than for the Rock Creek site. Site is privately owned and would require removal of residences. No distinct advantages over the Rock Creek Site.	Thompson 1989
Swamp Creek (MAC Report Site 21)	Downstream Method	Same as upstream. Excessive amount of borrow required (10 million cubic yards).	Thompson 1989
Swamp Creek/Rock Creek Combined Site	Downstream Method	Same as for Swamp Creek. Total disturbance area of approximately 700 acres .	Thompson 1989
Noxon Bench/Rock Creek	Downstream Method	Same as for Noxon Bench. Total disturbance area of approximately 700 acres.	Thompson 1989
McKay Creek	Downstream Method	Greater impact to Waters of U.S. and wetlands and diversion of a perennial stream.	Thompson 1989

Reclamation of the impoundment face would not have begun until operations were completed because the downstream method of construction continually adds more tailings on the outside slope as the embankment is built. There would have been enough soil available for salvage to place up to 4 feet of soil on the impoundment (top and embankment).

Environmental Consequences

Under this alternative, impacts associated with construction and operation of mine and mill facilities and roads would have remained. Impacts associated with the Rock Creek impoundment were avoided but replaced by those described below.

The downstream method of construction has some benefits. Less borrow material (the amount cannot be determined at this time) would have been required and thus less possible disturbance of land outside the impoundment footprint. The embankment would have been inherently more resistant to earthquake-induced liquefaction without design modifications such as are described for the Rock Creek impoundment in Alternative III. (If tailings material is properly placed and additional design parameters are incorporated, then any impoundment could be equally stable.) To assure meeting design specifications, the downstream method of construction requires less testing and operations control than other construction methods.

Storm waters falling in the 7,000-acre drainage basin upstream would channel considerably more water through either the diversion channel or the reconstructed stream than would have been diverted around the Rock Creek impoundment. The Rock Creek impoundment site has an upslope drainage area of approximately 200 acres. The diversion channel and the reconstructed stream would have been sized to handle the flows from the drainage basin. However, because of the larger drainage basin, the consequences of dam failure would have been greater.

Hydrologic impacts to Miller Gulch and Rock Creek from the proposed impoundment would have been shifted to McKay Creek. A lack of baseline data for McKay Creek, however, prevented the development of a quantitative analysis. Impoundment seepage would have either flowed into the ground water and/or discharged into McKay Creek and then into the Clark Fork River. Assuming that seepage quantities and qualities were similar to those estimated for Alternative II, impacts to the Clark Fork River should have been similar. However, since McKay Creek drains into the reservoir above Noxon Rapids Dam, it may have taken longer for impacts from an impoundment failure to move downstream through this slower-moving body of water.

This alternative would have filled in nearly 43 acres of Waters of the U.S. and wetlands in the McKay Creek drainage. This alternative would have eliminated impacts to wetlands at the Rock Creek impoundment site. If any bull and/or westslope cutthroat trout lived or spawned in the 13,000-foot stretch of McKay Creek directly impacted by the impoundment, then those fish would have been severely affected by the loss of habitat and access to the stream below the impoundment. The possible loss of fish could have affected recreational and tribal fishing opportunities within the affected portions of McKay Creek. If there were any pure strains of either species upstream of the impoundment, then the barrier to and from downstream stretches would have helped to isolate and protect those populations.

This impoundment location would have required more road closures by KNF to mitigate impacts to grizzly bears than any of the action alternatives due to its greater disturbance area. The impoundment also would have destroyed more elk wintering grounds than other alternatives. Displacement of game species from the McKay Creek drainage could have affected recreational and tribal hunting opportunities there.

Land that would have been impacted by this impoundment alternative currently is owned by the state of Montana and private timber companies. ASARCO would have been required to lease or purchase privately owned lands, and lease, purchase, or persuade DSL Lands Division (part of the new Department of Natural Resources as of July 1, 1995) to agree to a land exchange for the state land.

Although this impoundment would not have been visible from Montana Highway 200, it would have been more visible from wilderness trails accessing the CMW (Wanless Lake, Bear Paw, and Goat Ridge trails) as well as from both Goat and Engle peaks than the Rock Creek impoundment. This impoundment would have been more visible from these sensitive areas because it would have been closer to them. Visual impacts would have been adverse, long term, and significant to those recreationists and visitors who valued the existing, natural-appearing landscape in this drainage.

Reasons for Dismissing This Alternative

Although the McKay Creek site did provide the means to construct a downstream impoundment that was not visible from viewpoints in the Clark Fork Valley near Noxon, it created a number of significant negative impacts associated with other identified issues. Therefore, the McKay Creek alternative was dismissed from further consideration for the following reasons:

1. Because tailings impoundments at most sites can be designed and built to meet a certain level of stability, there was no comparable advantage to the downstream method of construction. The Rock Creek impoundment could be further modified to attain the same strengths even though more geotechnical testing and operational controls may be required.

2. This alternative would have impacted the greatest total area (742 acres) compared to alternatives II through IV (i.e., 30 percent more land disturbed than Alternative II).

3 Placing the impoundment in McKay Creek would have generated disturbances in two different perennial drainages as opposed to one for alternatives II, III, and IV.

4. There would have been severe, long-term impacts to aquatics/fisheries resources due to the elimination of a large amount of stream habitat. There also would have been increased water temperatures, and increased sedimentation due to the diversion and reconstructed stream.

5. This alternative would have affected the greatest amount of Waters of the U.S. and wetlands (43 acres). It is a 404(b)(1) requirement that the selected permitted alternative be the least damaging practicable alternative. It is therefore unlikely that COE would approve a 404(b)(1) permit for this alternative. It is also unlikely that DHES would issue a 401 certification for the 404(b)(1) permit. This is based on section 75-5-605(1)(a)

MCA which makes it illegal to place or cause to be placed any waste in a location where it is likely to cause pollution of state waters. Wastes include any substance produced or disposed of from natural resource development, including mining. It is also departmental policy not to permit tailings impoundments in a drainage other than headwater locations.

6. This impoundment would have required perpetual maintenance of the spillway and stream channel to prevent erosion near the dam and potential erosion of the embankment, leading to potential impoundment failure.

7. Impoundment failure during a PMF likely would have sent flood waters and some tailings downstream into Noxon Reservoir.

8. This impoundment probably would have been a high hazard facility according to Montana's Dam Stability Act and would have required permitting by DNRC after bond release.

9. While visual impacts to people using Montana Highway 200, recreating at Noxon Reservoir, and living in the Clark Fork Valley would have been mitigated, this alternative would create a significant, long-term visual impact to recreationists in McKay Creek drainage.

McKay Creek Water Retention Dam

The 404(b)(1) permitting process requires mitigation for Waters of the U.S. and wetlands that would be impacted by construction of a tailings impoundment in McKay Creek. The use of a water retention dam to create a hydrologic regime capable of supporting constructed wetlands was considered but dismissed for the following reasons.

1. An entire water retention dam would have to have been designed and built prior to placement of tailings rather than starter dams and a staged embankment.

2. Such a dam would require more expense, would be more massive, and might necessitate transport of construction materials from off site, resulting in a structure similar to a conventional reservoir dam. This would probably classify the dam as a "high hazard dam" subject to the requirements of the Montana Dam Safety Act once the impoundment had been reclaimed according to an approved permit reclamation plan.

3. Stored tailings would have remained thoroughly saturated and therefore more liquefiable material, increasing the risk of downstream damage if the dam had failed. In comparison, tailings behind a staged embankment would have a decreased risk of downstream movement and associated damage as they dewatered and became more stable over time.

4. The ability of the site and materials to maintain the hydrologic balance necessary to support wetlands was uncertain. Factors that could play a role include the amount of streamflow in McKay Creek, permeability of underlying bedrock and alluvium, and precipitation.

5. Replacement wetlands could not be constructed on top of the impoundment until after mining operations had ceased and the impoundment could be reclaimed. COE prefers to have replacement wetlands constructed prior to destruction or filling in of existing wetlands.

Other Tailings Disposal Methods

The Agencies considered and dismissed the following two other methods of tailings disposal: 1) dry tailings and 2) backfilling of tailings into the mine.

Dry Tailings

The term "dry" tailings is somewhat misleading. The tailings are not actually dry; they are dewatered (75 to 80 percent solids by weight) to the point that they can be handled mechanically and placed at a disposal site as a moist material rather than a hydraulically placed slurry. This technology has emerged over the last decade and is used in the metal mining industry primarily in the disposal of tailings from smaller gold mining operations.

Dewatering could take place at either of two locations depending on the method of conveying the tailings to the disposal site. If dewatered at the mill site, tailings would be too dense to pump and would need to be conveyed to the tailings disposal site by some mechanical method. Alternatively, the slurry could be pumped from the proposed mill and then dewatered at the tailings disposal site. Water generated from this process would need to be captured for reuse or treatment. Moist tailings are mechanically placed using conventional earthmoving methods (i.e., trucks, conveyors, stackers, bulldozers) to construct an earthen fill. Such a fill may, depending on specific engineering properties of the tailings and disposal location, be retained behind a dam, be self-supporting, or a combination of the two.

The existing filtration methods for creating dry tailings have only been proven to be economical for small-scale operations on the order of hundreds of tons of tailings per day. The proposed project would process approximately 10,000 tons per day of tailings.

The Agencies do not consider this to be a viable tailings disposal alternative for the following reasons:

- technical and operational difficulties that could result from having to mechanically handle large quantities of tailings;

- probable need for a backup wet tailings storage; and
- increased capital and operating costs.

Backfilling of Tailings

The Agencies conducted an analysis to determine whether tailings could be backfilled into the mine and whether backfilling would reduce the amount of disturbance associated with the tailings surface disposal. The placement of tailings in underground mines is common practice in the precious metal mining industry. Its primary purpose is to provide physical support of the underground openings to allow continued mining rather than to provide tailings disposal. The critical question for this project is whether backfilling could both technically and economically allow for the elimination or significant reduction in the size of a surface tailings impoundment.

Sands. Historically, backfilling with tailings was used in underground mines that followed narrow, vertically oriented mineral veins rather than the thick, flat-lying ore zones of the proposed project. The sand fraction (sands), separated from the silt- and clay-sized (slimes) portion of the material, would be pumped in a water slurry to the underground mine openings (stopes). The sands allowed the water to freely drain and then settled into a compact mass in the stope. This sand-fill both supported the walls of the stope and provided a working floor for the miners to proceed with extraction of vertically oriented ore veins.

A further development of the sand-fill technology was the addition of cementing agents, usually portland cement, to the sand-fill to create a weak concrete. This resulted in a stronger backfill material and allowed for the mining of narrow vertical stopes surrounded by very weak rock. This method of cemented sand-fill also found use in the mining of thick horizontal ore zones, similar to those of the proposed project. Initial support of the stope roof (back) was supplied by leaving wide pillars of ore. Filling open stopes with cemented sand-fill allowed subsequent recovery of these ore pillars due to the support provided by the cemented sand-fill. In this manner, ore recovery would be greater than that obtained by using pillars for ground support.

Using the sand fraction as backfill leaves the slimes portion to be disposed. Based on estimates from the milling process at ASARCO's Troy Mine, approximately 60 percent of the tailings from this project would be slimes (Dames and Moore 1993). Thus, if sand-filling was used, only about 40 percent of the tailings would be placed in the underground openings as part of the mining procedure; the remaining 60 percent would be disposed of in another way, and most likely in a surface impoundment.

Safe disposal of fine-grained slimes in a surface impoundment requires construction of a retention dam. Since the bulk of the sand portion in tailings typically is used to construct an embankment, alternate construction material would be needed to build the dam should the sand fraction be returned underground as part of a backfilling scheme. Despite the reduction in volume of material to be disposed of on the surface, the overall size of the retention dam and the retained slimes would still approximate that of the proposed impoundment because of the topography and basin geometry of the proposed impoundment site. In addition, substitute embankment construction material, equal in volume to the sands initially proposed for construction, would need to be identified. Depending on the height of each incremental embankment raise, the total substitute volume needs could be as high as 40 million cubic yards. Therefore, use of sand-fill would not appreciably affect the footprint of the tailings impoundment, yet would require an additional disturbance area to supply construction material for a slimes retention dam.

Slimes. Disposal of the separate slimes fraction in the underground mine would require creation of additional space by removal of the ore pillars and use of substantial bulkheads constructed to contain the slimes in the stopes between the cemented sand-fill pillars. Based on discussions with specialists from the U.S. Bureau of Mines (Ron Backer, Dave Denton, Douglas Bolstad, and Richard Grabowski, U.S. Bureau of Mines, personal communication, July 21, 1994) this method of tailings disposal is not practiced in the mining industry, is not a proven technology, and is not likely to be economically viable as a tailings disposal method.

Unsegregated Tailings. Sand-fill, as a potential tailings disposal alternative, generates the need to dispose of the slimes fraction apart from the sand. The mining industry and government agencies have conducted research into whether to use both sand and slimes (whole tailings) as backfill. Ongoing research in the use of whole tailings for backfill is now beginning to move into industrial-scale applications. However, to date, whole tailings backfill at the scale of the proposed project are limited to applications requiring cemented backfill for underground support and are integral to the economics of the mining method necessary for recovery of the ore (Lani Boldt, U.S. Bureau of Mines, personal communication, June 5, 1993; Jim Vickery, Kennicott Copper Company, personal communication, June 5, 1993). This is not the case for the proposed project and this technology is not proven as an economic tailings disposal method.

The most significant factor limiting backfilling is that most of the tailings cannot fit in the underground space due to the increased volume resulting from grinding the ore. At Noranda's Montanore Project for example, testing indicated over a two-fold volume increase (Noranda Minerals Corp. 1989). Therefore, even if backfilling were used, a surface impoundment would still be needed to accommodate the surplus tailings from the milling process. The size of this impoundment would be dictated by the volume of tailings which could actually be returned underground. Given the present impoundment location and its topography, if 50 percent of the whole tailings could be stored underground, the embankment height would be reduced by about 135 feet, while the surface footprint would be decreased by a mere 20 acres. This decrease in size would be primarily along the north edge of the impoundment.

Underground storage of cemented tailings (backfilling) could provide potential benefits by:

- partially reducing the size of the required surface impoundment;
- reducing the risk of surface subsidence -- providing underground support in areas not presently designated for artificial supports beyond the designed pillar layout; and
- allowing increased ore recovery when substituted for the unmined support pillars.

Backfilling was dismissed from further consideration for the following reasons.

- A surface impoundment could not be eliminated or significantly reduced in size.

- Designated embankment construction materials would require development of an alternate material source and accompanying disturbance area.

- Backfilling with whole tailings is not a proven technology at the scale (production rate and volumes) of the ASARCO project. The vast majority of backfilling operations occur at precious metals mines where the economics are more favorable. The operating costs per ton of ore mined would be too high for a base metal operation like Rock Creek. Based on available information, the approximate cost of cemented backfill alone ranges between $3 and $12/ton (Astle and Knight 1990); metals value per ton of ore at Rock Creek average $25/ton based on current spot market prices. When other operating and capital costs are factored in, the cost to produce a ton of ore could be uneconomical if backfilling were part of the program. Conversely, the cost of surface tailings impoundment disposal averages between $0.80 and $2.50/ton (Hutchison and Ellison 1992).

Rail Siding (Load-out) Alternatives

As discussed in Alternatives Description, ASARCO proposes to haul copper/silver concentrates produced at the mill by truck to the existing Hereford railroad siding 3 miles north of Noxon adjacent to Montana Highway 200. A covered tractor-trailer combination would haul concentrates to a newly constructed load-out facility between 8 a.m. and midnight, 7 days a week. Transporting the estimated 51,000 tons of concentrate produced annually would require about eight round trips per day.

Therefore, in consultation with the shipping railroad, Montana Rail Link, the Agencies developed the following alternatives to find a rail siding location that would limit or eliminate the amount of time and miles concentrate trucks would be on Montana Highway 200. All alternate rail siding locations are technically feasible as to grade (siding and access road) and right-of-way width.

Modified Miller Gulch

Access to this siding location would be via Montana Highway 200 from the junction of new FDR No. 150 for about 1.0 mile to existing FDR No. 150, then over 0.75 mile of Government Mountain Road, and finally over about 0.25 mile of new road to the siding. About 1,200 feet of track would have to be constructed, at a cost of $220,000 (see **Figure 2-27**).

The proposed means of accessing this rail siding from Montana Highway 200 has been dismissed. Increased traffic congestion and decreased safety would be greater than the project proposal. Concentrate ore trucks would not reach designated highway speeds before having to slow down to make turns off the highway. However the rail siding site was retained for alternatives III and IV.

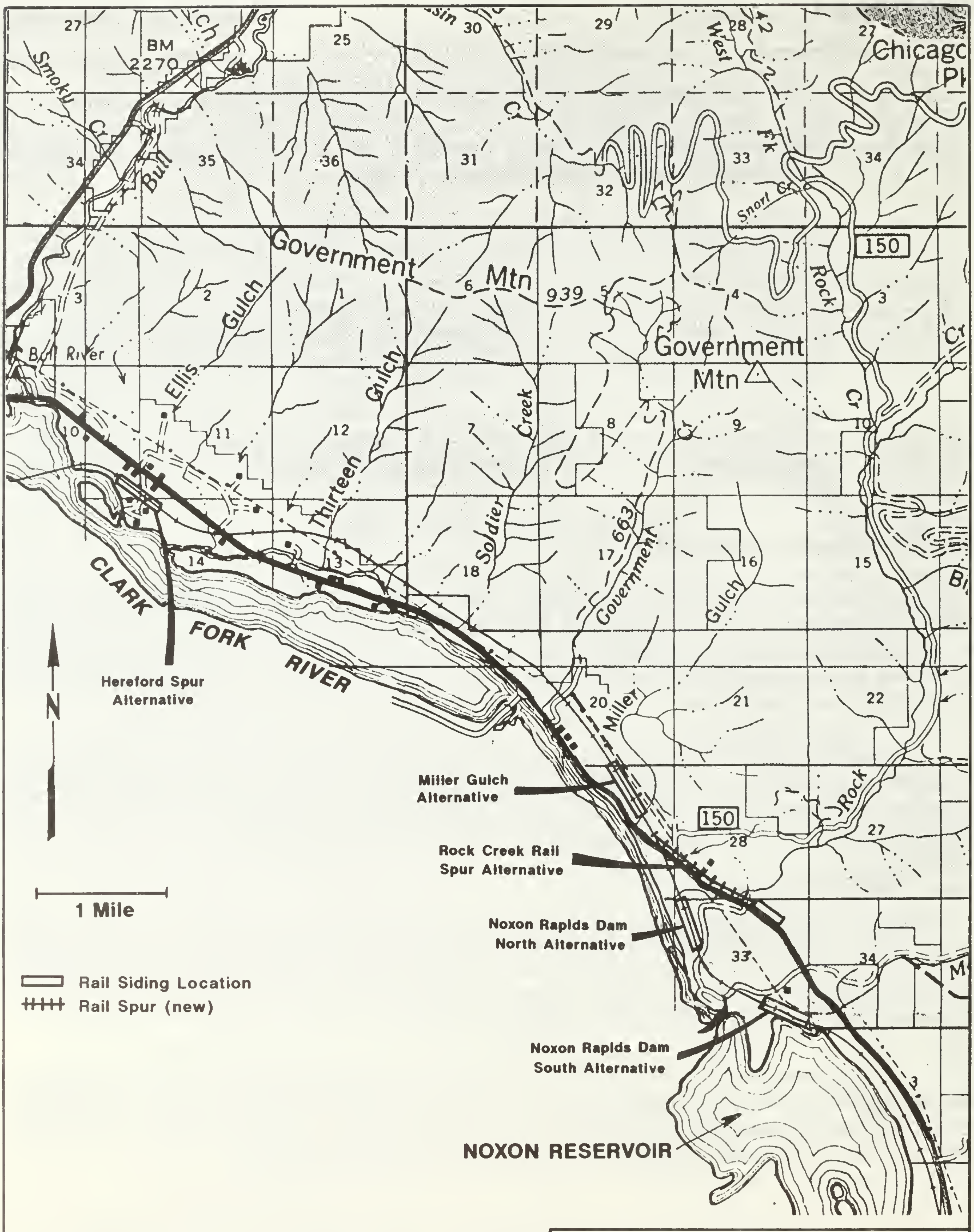


FIGURE 2-27
Rail Siding (Load-Out) Alternatives
Rock Creek Project

Rock Creek Rail Spur

No highway access would be necessary for this alternative. Access would be via a new road connecting FDR No. 1022 and new FDR No. 150. The combined 13,000 feet of new access road and track would cost about $800,000 to $1 million and would need to cross both Rock Creek and Miller Gulch (see **Figure 2-27**).

The Rock Creek Spur alternative was dismissed because it would require another bridge crossing of Rock Creek and greater cost. In addition, Montana Rail Link (MRL) prefers not to build dead-end spurs.

Noxon Rapids Dam South

The Noxon Rapids Dam South rail siding alternative would require some additional road construction. The existing road intersection with Montana Highway 200 does not meet MDT criteria for sight distance. An alternative would be to construct the Montana Highway 200 intersection immediately across from the FDR No. 150 intersection. Such an intersection would preclude ore trucks from having to pull onto the highway and then exit 0.25 mile away. About 1,500 feet of road would need to be constructed from Montana Highway 200. Then about 800 feet of existing road, Noxon Dam Road, and the Montana Highway 200 intersection would be obliterated. A 0.25-mile segment of new road would have to be constructed to access this siding location. Either side of the main line could be used for rail siding. About 1,200 feet of track would have to be constructed, at a cost of $200,000 (see **Figure 2-27**).

The Noxon Rapids Dam South alternative was dismissed because the access to it uses the Washington Water Power's (WWP) road and passes immediately adjacent to their barracks. It is also within 200 yards of the reservoir, a potential problem in the case of a spill.

Noxon Rapids Dam North

Access to this site would be from new FDR No. 150 and north onto Montana Highway 200 about 0.5 mile. Trucks hauling concentrate from the mine would have to turn left (west) onto an unnumbered road paralleling the south side of Rock Creek, leading to the rail siding. About 1,200 feet of track would have to be constructed, at a cost of $200,000 (see **Figure 2-27**).

The Agencies dismissed this alternative because it would increase congestion on Montana Highway 200 and decrease safety more than the project proposal. Concentrate trucks would not reach designated highway speeds before trucks would need to slow down to make left-hand turns. The alternative is also in close proximity to WWP's barracks. MRL stated that this was not a feasible site due to railroad alignment.

Combined Operations (Rock Creek and Montanore Projects)

During the EIS scoping process, including meetings with cooperating agencies, the Agencies identified a potential alternative of combining the Rock Creek project with the approved Montanore project. The Agencies explored the possibility that combining the mining operations might diminish the overall impacts of mining ore bodies under the CMW; the two companies would mine from separate directions, one on either side of the Cabinet Mountains using the approved Montanore adits. Under a combined mine scenario, the companies could mine the two ore deposits sequentially, thus extending the mine life over a 45-year period, or they could mine the two ore bodies simultaneously over a 15-to-30-year life.

To analyze sequential mining of the two ore deposits, the Agencies made the following assumptions:

- The most efficient mining operation is for one company to mine the deposits and process the ore using Noranda's planned mill in Ramsey Creek.
- Noranda's issued federal and state permits/approvals could legally be revoked in favor of a new alternative that requires that Noranda and ASARCO combine their operation, or Noranda's permits remain, but would be modified to include developments necessary to process ASARCO's ore. (The Hard Rock Mining Act and Forest Service specify very limited reasons for revoking permits and plans of operation. Therefore, revocation would be highly unlikely.)
- Noranda would mine their Rock Lake deposit (Montanore Project) first as approved in 1993.
- Noranda's Rock Lake deposit would be mined on schedule and the mined-out workings would be available for permanent tailings storage.
- The swell factor from in-place rock to tailings is 215 percent (from 166.7 pounds/cubic foot for in-place rock to 77.6 pounds/cubic foot for tailings).
- The exploration adit, as proposed by ASARCO, would be constructed to evaluate the ore zone and the Copper Creek fault, to obtain rock mechanics data to aid in underground mine design, and to obtain a bulk ore sample for metallurgical testing.
- The combined project's tailings impoundment would have had the following characteristics. Dam height - 430 feet, crest length - 3,700 feet, impoundment area - 280 acres, volume of starter dam - 4.2 million cubic yards, volume of dam - 28 million cubic yards, realign road - 9,700 feet, Ramsey Creek watershed above dam - 2,430 acres, two diversion dams and channels required, length of diversion channels - 23,000 feet.

Some years prior to completing the Montanore project, the miners would drive the Rock Creek exploration adit. Assuming favorable evaluation results, construction would begin on two parallel adits each 25 feet wide by 20 feet high for a distance of 24,015 feet to connect the Ramsey Creek mill to the Rock Creek deposit primary crusher location. This construction would create 900,000 cubic yards (2 million tons) of waste rock. At this juncture, Noranda's Little Cherry Creek tailings impoundment would have reached capacity and construction would start on another impoundment, probably in Midas Creek.

A primary advantage of using a sequential joint operation would be the ability to use the Montanore mined out underground workings for storing a portion of Rock Creek deposit tailings. In addition, the Montanore workings would decline continuously to the northwest allowing storing of whole tailings (coarse and fine) without the addition of cementing agents.

Noranda plans to remove 42.3 million cubic yards (95 million tons) of material. Theoretically, this allows the backfilling of 42.3 million cubic yards; however, only 60 percent of the available area is below the Ramsey and Libby Creek adits. To backfill the mine workings up grade from the adits requires the construction of a 16,000-foot-long adit from the Ramsey Creek mill site to the upper end of the Montanore workings. In addition, Libby Creek adit would need sealing to withstand the pressure of the backfilled tailings. The Agencies only considered using the down-grade mine workings for backfilling because use of up-grade workings requires sealing mine workings which creates long-term failure risks and requires the construction of an additional adit.

Mine workings from mining the Rock Creek deposit could also be backfilled with whole tailings. However, because the Rock Creek deposit is relatively flat lying, sealing of the mine workings probably would be required to hold backfilled tailings. It was estimated that only 20 percent (8.9 million cubic yards) of the mine workings would be acceptable for backfilling tailings. The capacity of the down-grade Montanore workings is about 26.7 million cubic yards. It was estimated that about 35.6 million cubic yards of tailings could be backfilled into the Montanore and Rock Creek mine workings.

Assuming Montanore's 215 percent swell factor, it was estimated that the Rock Creek mine would generate about 100 million cubic yards of tailings and that about 35.6 million cubic yards of tailings could be backfilled into the Montanore and Rock Creek mine workings. A tailings impoundment would be required to dispose of the remaining 64.4 million cubic yards of tailings. The most likely impoundment site would be Midas Creek, analyzed in the Montanore EIS.

Under this alternative, the impacts of the surface storage of tailings at Midas Creek would be greater than that from using the Rock Creek tailings impoundment site for the following reasons:

- Though the Midas impoundment would be smaller in acres, the dam would be 105 feet higher and require the diversion of two perennial streams (2.4 miles or 200 acres of stream disturbance).
- Six and one-half acres of wetlands would be impacted by the impoundment which is equal to the total acres impacted by the Rock Creek proposal.
- Two hundred and six acres more of old growth would be impacted.
- Ten million cubic yards would be excavated to create the diversion channels.

The advantages associated with this alternative would be the use of one mill and associated facilities for both operations. Other than ASARCO's exploration adit, only the east side of the Cabinet Mountains would be disturbed; impacts to resources in the Rock Creek drainage would be avoided.

Though there are some advantages to this alternative, they are outweighed by the disadvantages. The two parallel adits would pass through the Rock Creek fault. Because of the potentially high hydrologic conductivity of rock in and near the fault zone, the Agencies have required that Noranda maintain a 100-foot barrier pillar between the fault and underground workings until studies determine whether closer mining could be safety conducted. It is unknown at this time whether penetrating the fault with 2 large adits would be an environmentally or structurally sound practice.

Regardless of which side of the mountain is used for milling the Rock Creek deposit, a second tailings impoundment would be necessary. Underground storage of the total volume of tailings is not possible. The combined operations would impact approximately 80 more acres than would two separate operations. Two diversion channels totaling 23,000 feet would be needed to divert Midas Creek and a tributary. The same amount of Waters of the U.S. and wetlands would be affected by either alternative. Significantly more old growth ecosystem would be impacted by using the Midas Creek impoundment. In addition to the environmental and engineering reasons for dismissing this alternative, there are significant timing, legal, and liability issues associated with requiring two corporations to work together.

Another option would be to mine the two ore bodies simultaneously over a 15-to-30 year life using Montanore's previously permitted Ramsey Creek mill site on the east side of the mountain. Under this option, the Agencies assumed companies would operate at their proposed rates: 10,000 tons per day for ASARCO and 20,000 tons per day Noranda. This would necessitate the excavation of two 24,000 feet adits that would connect ASARCO's proposed crusher site with Noranda's mill. This would be in addition to the three adits proposed in Noranda's approved plan of operation. Either an additional mill would need to be constructed or the proposed mill expanded to handle the 30,000 tons-per-day of ore. By mining simultaneously, two tailings impoundments capable of handling a total of 200 million tons of tailings plus the associated roads and slurry/reclaim lines would need to be constructed. Less than 10 percent of the tailings could be stored underground because of the difficulty in stabilizing tailings in a work environment. A tailings impoundment in Midas Creek would be constructed in addition to Montanore's approved Little Cherry Creek tailings impoundment. The transmission line may be capable of carrying the additional load, but a detailed analysis would be necessary to make a final determination.

This option does not offer any significant environmental advantages over ASARCO's proposal and it is questionable if the mill could successfully process 30,000 tons per day. In addition to the environmental and engineering reasons for dismissing this alternative, there are significant timing, legal, and liability issues associated with requiring two corporations to work together. For these reasons, this option was dismissed from further study.

Other Water Treatment Methods

Water treatment alternatives that were considered and dismissed by the Agencies include: (1) land application disposal (LAD) of excess mine adit discharge and mill process water, and (2) constructed wetlands. The LAD alternative consists of several disposal options including percolation ponds, drip irrigation, and spray irrigation. The constructed wetlands option consists of wetland cells, ponds, and a meadow. The rationale for dismissing each option is provided below.

Land Application Disposal

Percolation Ponds. Potential sites for percolation ponds or infiltration galleries were identified on about 100 acres of the Clark Fork River gravel terraces, and on 15 acres of Rock Creek alluvial deposits. These sites were selected because of their ability to transmit large volumes of water. It was estimated up to 1,700 gpm of excess water could be disposed of in a series of percolation ponds. The use of percolation ponds would be restricted by severe winter weather conditions for at least part of the year.

The use of percolation ponds was dismissed as a primary alternative for disposing of excess mine and process water for several reasons. The use of percolation ponds on gravel terraces or alluvial deposits would likely result in the formation of springs and seeps that would directly discharge into Rock Creek and the Clark Fork River. Springs and seeps could cause erosion and increased sediment loading to the receiving streams. In addition, the percolation ponds would have little effect on the initial quality of the discharge. ASARCO estimated that the maximum removal efficiency for nitrate and ammonia that they could obtain using a combination of percolation, infiltration, and spray or drip irrigation was 20 percent. The potential would exist to affect ground water quality and existing beneficial uses of ground water.

Drip or Spray Irrigation. Two irrigation sites were identified for disposal of excess water by either drip or spray irrigation. One site consists of approximately 160 acres and is located on a hill to the northeast of the proposed tailings impoundment. The other site consists of about 225 acres located north of Montana Highway 200 between Rock and McKay creeks. Up to 800 gpm could be disposed at the two irrigation sites, less than half of the average anticipated discharge during operation. Relatively large areas of land would be disturbed, and the cost of maintenance would be high.

Drip or spray irrigation could be used only for about 150 days of the year; freezing, precipitation, and saturated soil would reduce soil infiltration capacities, hampering operations the remaining 215 days. Spray or drip irrigation by itself could remove a larger percentage of nitrogen (up to 80 percent) if the volume to be treated was much lower or there was adequate land available. Based on these considerations, the use of drip or spray irrigation was dismissed from further consideration.

Constructed Wetlands

Constructed wetlands treatment consists of a primary sedimentation basin, wetland treatment cells, shallow pond, and wet meadow. The critical design criterion for sizing the components of a constructed wetlands is the hydraulic residence time (HRT); the total time that water remains in the treatment cells prior to discharge. Based on typical HRTs of 5 to 7 days to achieve 80 percent treatment (primarily denitrification), the required area for the wetland cells was calculated to be approximately 100 acres. Furthermore, additional area would be required for the sedimentation basin, shallow pond, and wet meadow. Based on preliminary calculations, the constructed wetlands treatment option was dismissed because adequate land area within the proposed permit area does not exist. There is also the possibility that the constructed wetland would not be as effective during winter months.

Socioeconomic Alternatives

Construction Employment Cap

The Agencies considered a construction employment cap to moderate the anticipated boom/bust employment cycle and its associated socioeconomic effects. The Agencies would have imposed an employment cap so that construction employment generally would not have exceeded mine operations employment of about 350 project workers. Construction workers, family members, and indirect workers would have totalled about 390 construction-phase immigrants (25 percent less than Alternative II level of 483 immigrating persons). The construction employment cap would have moderated socioeconomic boom effects to more closely match mining-phase employment and local government infrastructure needs.

Temporary Work Housing

This measure was considered to mitigate housing shortages associated with construction employment. ASARCO would have been required to provide direct or contracted assistance for construction worker housing (such as company assistance in developing a mobile home court or a suitable work camp)(Wenner 1992). Because of the temporary work situations of most construction workers, it is unusual for construction workers to purchase or build new housing. More typically, construction workers use temporary housing such as motels or mobile homes. Because there is insufficient local housing, construction workers would be forced to commute long distances (more than 50 miles) or to bring trailers or mobile homes into the area. Some mining companies have developed mobile home courts to serve temporary construction worker housing needs (Wenner 1992).

Reasons for Dismissing These Alternatives

DSL does not have the authority under the Hard Rock Mining Act to require these alternatives. Since the majority of these mining-related impacts would accrue to local governments, affecting their ability to provide services, mitigation of these impacts falls under the jurisdiction of the Hard Rock Impact Act (see Chapter 1). ASARCO, Sanders County, and the Hard Rock Impact Board could incorporate measures similar to these into ASARCO's Hard Rock Impact Plan.

PART IV: DESCRIPTION OF REASONABLY FORESEEABLE ACTIVITIES

This section discusses reasonably foreseeable activities proposed near the Rock Creek study area. Reasonably foreseeable activities are those that have been proposed in specific enough detail to allow evaluation at this time.

Timber Sales

There are currently no timber sales under contract on NFS lands within the ASARCO project area. KNF is proposing one timber sale in the Rock Creek drainage within the next 10 years (see **Figure 2-28**). The proposed Cedar Gulch sale (2-3 MMBF) will be offered in 1996. This sale, and any others that might be proposed, will be subject to analysis under NEPA at the time of proposal. Sales may be modified or possibly dropped depending on the outcome of the assessment.

Postharvest activity on each of these sales may include the following:

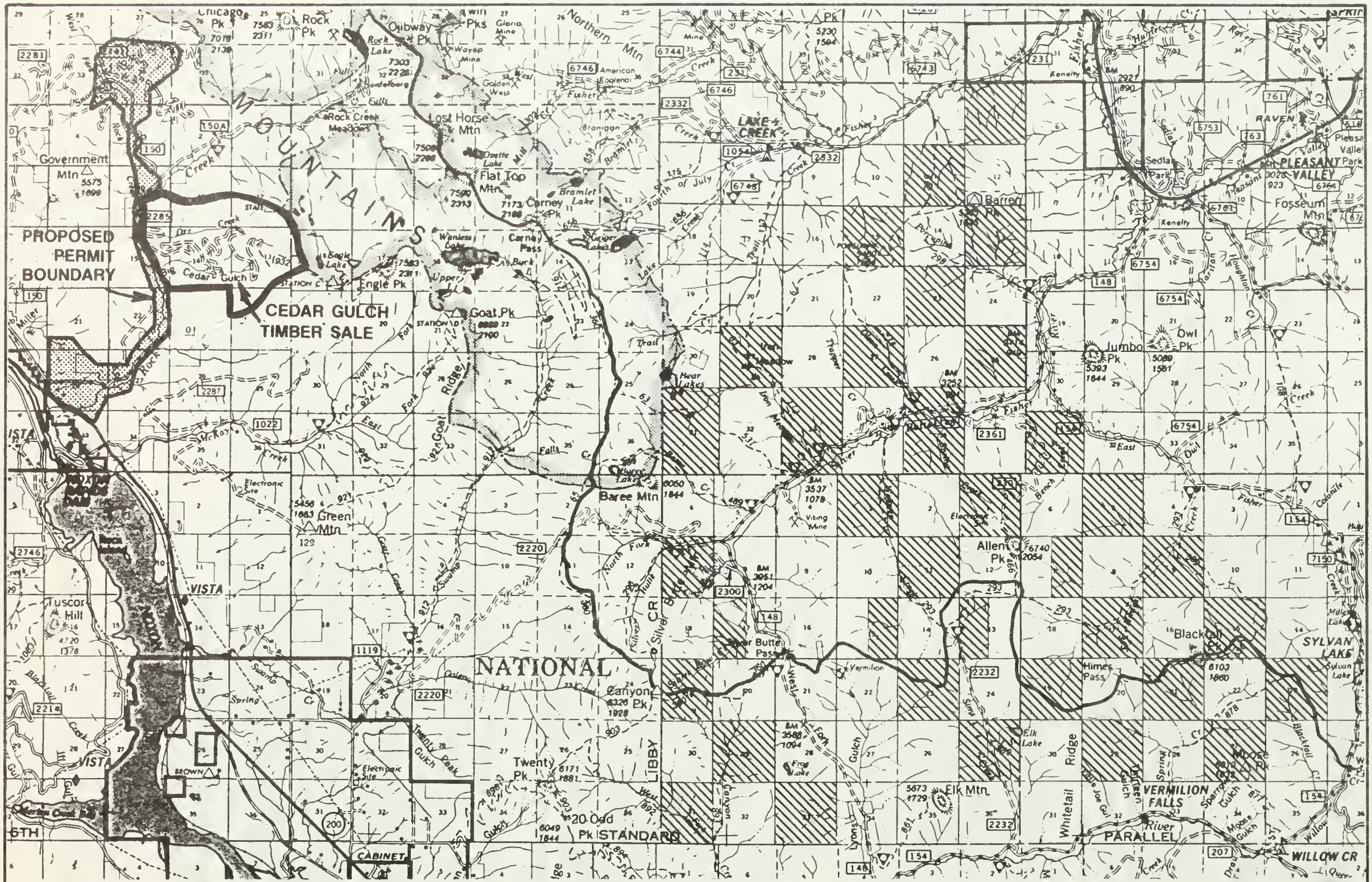
- underburning 1 year after logging to remove slash and prepare areas for planting. Where slash is low in volume, the units would be lopped and scattered in order to facilitate planting;
- reforestation by planting;
- permanent closure of all newly constructed roads. Temporary roads would be seeded to mixed grasses for soil stabilization. Some may be recontoured to slope and revegetated;
- regeneration monitoring conducted in years 1, 3, and 5 after planting; and
- possibly, controlled burning to improve wildlife habitat, installation of structures in streams to provide habitat and allow fish passage, and reconstruction of recreational trails.

This information is based on what has occurred in the past on the Cabinet Ranger District. Additional details for these projects cannot be determined until an environmental analysis is conducted.

There probably would be logging activities occurring on private lands in the Rock Creek drainage within the next 30 years. However, there is no information available to predict when and where they would occur.

Montana Highway 200 Improvements

Montana Highway 200 is a paved, double-lane roadway that begins at the Montana-Idaho state line and travels across Montana to the North Dakota border. This highway is in varying stages of reconstruction. Depending on availability of state funding, reconstruction is tentatively scheduled from milepost 62 to 68.7 in 1998; Noxon East/West from milepost 10 to milepost 29 in 1999; and Thompson River bridge east to milepost 62 in 1997. The junction of existing FDR No. 150 with Montana Highway 200 is about milepost 17.5 on the highway.



Section

▨ Plum Creek lands from which different alternatives would be made.

FIGURE 2-28
Cedar Gulch Timber Sale and Checkerboard Land Exchange
Rock Creek Project

Source: Kootenai National Forest.

Checkerboard Land Exchange

KNF is preparing an EIS for a proposal to exchange NFS lands for Plum Creek Timber Company Limited Partnership (PCTC) land. The project is located mid-way between Libby and Kalispell, Montana with the PCTC lands located about 15 miles east of Noxon.

PCTC owns approximately 47 sections of land for a total of about 30,000 acres, within the Silver Butte, East Fisher, West Fisher and Vermilion drainages on the KNF (see **Figure 2-28**). These sections alternate with NFS lands sections, and together they comprise what is referred to as the "Checkerboard" area on the KNF. The acreage of PCTC lands involved in a possible exchange vary by alternative (generally in the 20,000-acre range). The majority of the area is unroaded, and is characterized by a variety of land types from steep, rugged slopes to lush creek and river bottoms. Some of the area that burned in the early part of the century is covered by dense, lodgepole pine stands, while the unburned areas support virgin stands of cedar, white pine, western larch and Douglas-fir.

After KNF completed the Forest Plan, the draft EIS for the Forest Plan, and informal consultation with the U.S. Fish and Wildlife Service (USFWS), KNF proposed roadless management allocations for much of the NFS lands in the Checkerboard area. This designation was compatible with the grizzly bear recovery program and provided for old growth timber retention. To implement roadless allocations, KNF proposed that intermingled private land be added to the land acquisition plan. This became part of the preferred alternative in the draft EIS. USFWS stated the preferred alternative would not likely jeopardize the continued existence of grizzly bear on the KNF. In September 1987, the Regional Forester signed the record of decision for the KNF Forest Plan final EIS, providing for roadless management in most of the Checkerboard area with direction to consider acquisition of the intermingled private lands. This area provides a natural-appearing environment for the protection and enhancement of roadless recreation use while contributing to the protection and recovery of the grizzly bear. The undeveloped area possesses old growth habitat necessary for dependent wildlife species. The old growth represents a good cross-section of the major habitat types and tree species found on the KNF. Management objectives identified in the Forest Plan to provide roadless management are in conflict with PCTC land management objectives, as PCTC is planning to develop their lands and would need access. Under federal ownership, the area would be maintained and enhanced for grizzly bear habitat, for reduced grizzly/human conflicts, and to benefit other wildlife such as elk and mule deer. Areas adjacent to Forest System roads are managed for forest commodities. This enhances other resource values and protects the integrity of undeveloped areas.

Several options to acquire the private lands were discussed with PCTC and the public to meet Forest Plan direction for management of lands and their needs in the Checkerboard area. A final decision on the land exchange would be made in accordance with NEPA.

Road Closures

Forest standards (Kootenai National Forest 1987) for open road density in areas managed for grizzly bear habitat specify a maximum average density of 0.75 mile of open road per 640 acres. The KNF evaluates compliance with this standard for each bear analysis area (BAA). Current open road density exceeds the standard for BAA 7-6-1; this BAA would be affected by the Rock Creek Project. The KNF closed 6.3 miles of Forest System roads in 1994 to be in compliance with this standard (see **Table 2-10**).

TABLE 2-10.
KNF Road Closures in 1994

Road Number	Road Name	Miles
2287	McKay Saddle	1.9
2210	Engle Creek	3.3
14641	Rock Face	1.1
	TOTAL	6.3

Noranda Minerals Corp.

The Agencies approved construction of the Montanore Project (as described in alternatives 3C and 5 of that project's final EIS) in various decision documents (DSL, KNF, Department of Natural Resources and Conservation (DNRC), DHES, and COE). Noranda's modified plans are for continued evaluation and development of the project in a phased approach. Only those aspects of the project that have relevance for cumulative impacts evaluation are discussed below. Additional information on the Montanore Project can be found in the permit application (Noranda 1985) and final EIS for that project.

The proposed project would consist of six primary components: an underground mine, a mill, three adits and portals, a tailings impoundment, access roads, and a 16.7-mile transmission line. (See **Figure 2-29**.) Access to the project is via U.S. Highway 2, Bear Creek Road (FDR No. 278), Libby Creek Road (FDR No. 231), and upper Libby Creek Road (FDR No. 2316). Although some of Noranda's ore body is less than 1 mile from ASARCO's, the surface facilities would be almost 7 miles apart.

Mine

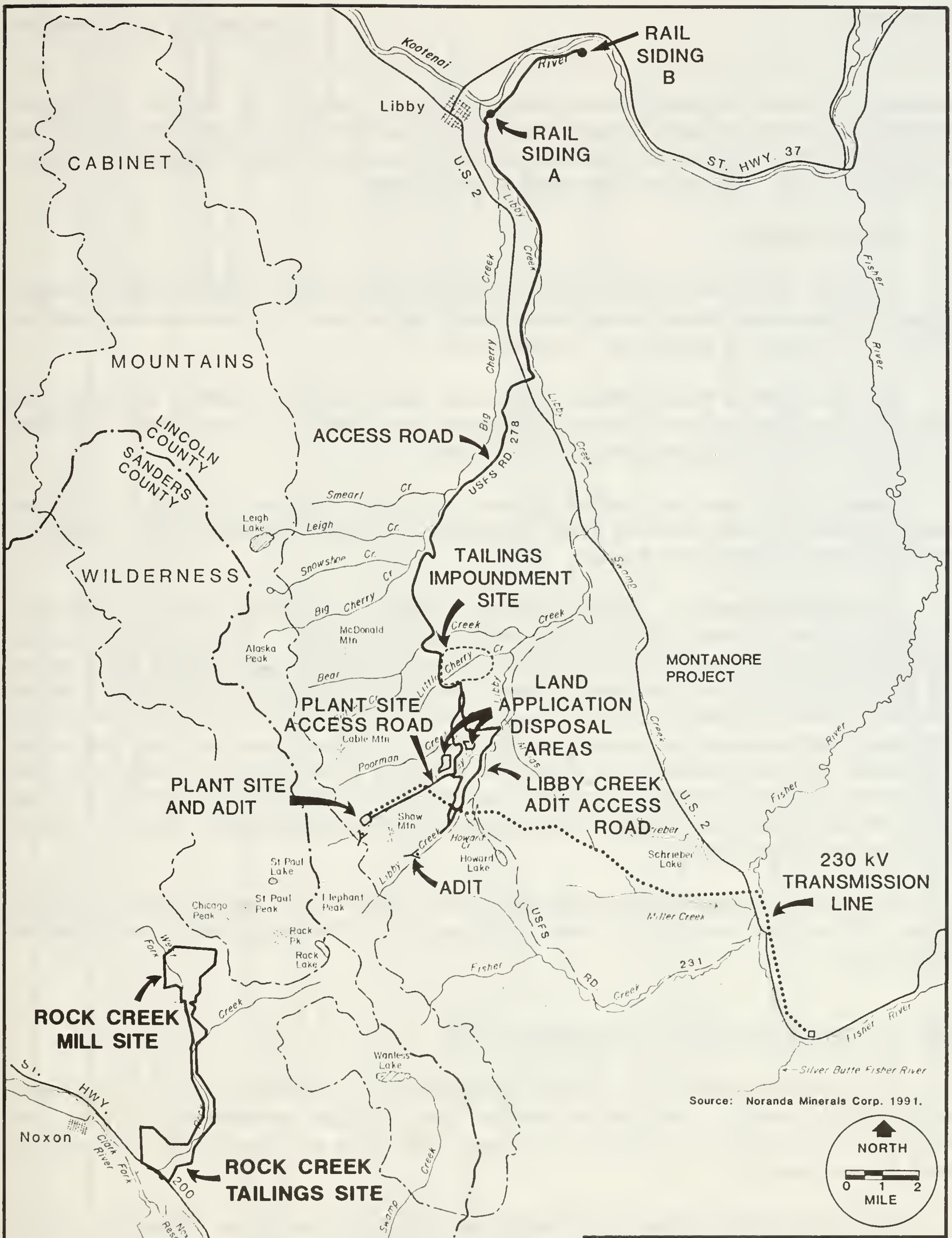
Three adit openings would be excavated to access the ore body for mining; two adits from Ramsey Creek and one adit from Libby Creek. The Ramsey Creek adits would include a main conveyor adit and a parallel main ventilation intake adit. The Libby Creek evaluation adit (two-thirds complete and currently on hold) would serve as an exhaust ventilation adit. About 95,000 tons of ore would be removed at a rate of 20,000 tons per day.

Mill

The mill would be constructed on the north side of the creek across from the Ramsey Creek portals. Concentrates would be dewatered and shipped off site by truck.

Tailings Disposal

The proposed Little Cherry Creek tailings impoundment area is located about 5 miles north of the Ramsey Creek mill complex. The impoundment area would consist of a diversion dam, diversion channel, tailings retention dam including a starter dam and toe dike, two earthfill dams, and seepage collection dam, encumbering about 994 acres. The tailings impoundment is designed to contain and



Source: Noranda Minerals Corp. 1991.

FIGURE 2-29
Montanore Project Proximity
Rock Creek Project

permanently store about 120,000,000 tons of tailings. During operation, the tailings impoundment embankment would be constructed using the "downstream" method using cycloned tailings sands. The tailings impoundment would be built in stages over the 16-year operating period and ultimately would cover about 445 acres, with the final dam height at about 370 feet.

Support Facilities

A number of support facilities would be required for this project. These include buildings, conveyors, storage areas, roads, parking areas, utilities such as electric power and communication, pipelines such as water and tailings, and associated corridors.

Once an approved water treatment system is in place, Noranda is expected to operate on a 24-hour, 7-day per week, year-round basis completing its final evaluations of the ore body. This phase would employ about 60 people and take about 1 to 2 years.

Construction of mine, mill complex and ancillary facilities could begin as soon as 1996, with limited production beginning as soon as 1998. This schedule is probably optimistic, however, and these dates may be pushed back by 2 to 4 years.

Personnel Requirements. Noranda would spend $200 to $250 million to develop the mine and anticipates an annual operating payroll of $12 million at full production. Construction would begin during the first quarter of year one with the hiring of about 30 employees and eventually would employ about 150. Construction would last about 2.5 years, peaking at 190 employees during the third quarter of year two. During year three, construction employment would be less than 100 employees. Total employment (construction and operations) is expected to peak at 530 employees during the third quarter of year three. Following completion of construction at the end of the third year of the project, total employment should level off at 450 workers and remain at this level through the life of the mine. These positions would be filled by hiring locally as much as possible. A training program would be established prior to and during operations.

The production schedule tentatively establishes three shifts per day, 7 days per week for 350 days per year. The estimated mine life is 16 years at full production. Postmining reclamation is estimated to last 2 years.

PART V: COMPARISON OF ALTERNATIVES

The alternatives analyzed in this EIS were developed in response to the significant issues identified during scoping. The Agencies identified eight significant environmental issues to drive development of alternatives and evaluation of impacts. (See Issues and Development of Alternatives Process for more detail.)

The next two tables summarize the descriptions of the action alternatives. **Table 2-12** provides a side-by-side comparison of mine development and operation features of each alternative. **Table 2-13**

TABLE 2-11.
ASARCO Rock Creek Project Alternative Comparison

Project Facility or Feature	Alternative II ASARCO Proposal	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations
Mill Site	Upper end West Fork Rock Creek	Same as Alternative II	Confluence of East and West forks Rock Creek
Tailings Impoundment	Rock Creek site 325 feet high, 324 acres, upstream construction	Same as Alternative II except modified centerline design w/technical review panel	Same as Alternative III
Adit Waste Rock Dump	Southeast of adit 600,000 tons	Above mill site 600,000 tons, some used to create millsite	No waste rock dump. 1,000,000 tons, most of which used to create mill site, remainder used for starter dam
Mine Adit, Length & Grade (to underground crusher)	Up Chicago Peak Rd (FDR No. 2741) 9,000' @+12.7%	Same as Alternative II	At confluence mill site 15,530' @+12%
Mine Adit Access	New 8,800' road @+6.5%, 20' wide with 50' ROW, graveled	FDR No. 150 reconst 1,100' to 24' wide, FDR No. 2741 & unnamed spur, reconst 7,900' to 24' wide, graveled	All within mill site boundary except for short spur off of FDR No. 150 for large equipment
Exploration Adit Length & Grade	Up FDR No. 2741 6,592' @-10%	Same as Alternative II	Same as Alternative II
Exploration Adit Waste Rock	178,000 tons, Placed downhill of adit entrance	Same as Alternative II	Same as Alternative II
Exploration Adit Road, Length & Grade	Upgrade FDR No. 2741 for 4.6 mi. & reconst 1,200' spur to 20' wide	Same as Alternative II	Same as Alternative II plus improve 2.8 miles of FDR No. 150 above confluence mill site
Exploration Adit Water Discharge Line	6" polyethylene line approx 8.5 mi. both X-C & along Rd 150, laid on surface for 3 yrs	Same as Alternative II	Same as Alternative II
New Road Construction	(1) 1.3 mi. new const beginning of FDR No. 150, 24' paved (2) Const 1.1 mi. of 16' graveled road around mill (3) N/A (4) Const 2.3 mi. of 20' graveled road from Sec. 15 to impoundment and const 5,500' of 20' graveled road in Sec. 3 & 10, both along slurry/reclaim lines (5) N/A (6) Const 1.6 mi. of 14' road around S & W of tailings imp for access to dam base. (7) N/A (8) N/A (9) See Mine Adit Access (above) for additional road work **TOTALS:** 1.3 mi. new paved and 6.0 mi. new gravel roads	(1) 2.3 mi. new const beginning of FDR No. 150, 24' paved (different location than Alternative II) (2) Same as Alternative II except 24' (3) Const 1,200' to connect FDR No. 150 to FDR No. 1022, gravel, 14' wide (4) Const 3,200' of 14' gravel road along slurry line, Sec 3 & 10 (5) 400' of 10' road for slurry/reclaim line (Rd150-B to water reclaim pump) (6) Const 1.6 mi. of 14' road around S end of tailings imp for access to dam base & rail load-out (paved w/turnouts) (7) Const 1,200' of 14' road to access rail load-out (paved) (8) Const 3,000' of 10' road - gravel for seepage collection line (9) N/A **TOTALS:** 4.2 mi. new paved and 2.6 mi. new gravel roads	(1) Same as Alternative III (2) N/A (3) Same as Alternative III (4) N/A (5) Same as Alternative III (6) Same as Alternative III (7) Same as Alternative III (8) Same as Alternative III (9) N/A **TOTALS:** 4.2 mi. new paved and 0.8 mi. new gravel roads

TABLE 2-11.
ASARCO Rock Creek Project Alternative Comparison (Cont'd)

Project Facility or Feature	Alternative II ASARCO Proposal	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations
Road Reconstruction	(1) FDR No. 150 to mill, widened to 24' & paved for 5.1 mi. (2) FDR No. 150B from FDR No. 150 to seepage collection system 3,600' of 14' (gravel) (3) N/A (4) Discharge line road to river 4,800 - 14' wide (dirt) (5) N/A (6) See exploration adit road for additional work **TOTALS: 6.7 mi.**	(1) Same as Alternative II, but 4.4 mi. (2) Improve FDR No. 150-B for 1.9 mi. from Rock Creek crossing to tailings impoundment, widen to 20' slurry line on inside edge of road (paved w/turnouts) (3) Government Mtn Road, 2,600' 14' wide (paved) to rail load-out (4) Discharge line road to river - 6,200' by 10' wide (gravel) (5) See Mine Adit Access (above) for additional road work (6) Same as Alternative II **TOTALS: 8.0 mi.**	(1) Same as Alternative II except only to confluence mill site, 2.9 mi. (2) Same as Alternative II (3) Same as Alternative II (4) Same as Alternative II (5) N/A (6) Same as Alternative II **TOTALS: 6.5 mi.**
Slurry and Reclaim Lines	From mill along FDR No. 150 to approx. center Sec. 3, then X-C to impoundment 5.1 mi. (two 10" high pressure urethane-lined steel slurry lines on piers, 1 buried 12' steel reclaim line) 3.4 mi. would be X-C, 9,100' along FDR No. 150	Same as Alternative II to SE of Sec. 15 then continues on FDR No. 150 to SE of Sec. 22 where it follows FDR No. 150-B to impoundment 3,200 X-C in Sec. 10 & 5.0 mi. parallels FDR No. 150	From mill along FDR No. 150 to intersection of old and new FDR No. 150, parallels FDR No.150B to tailings impoundment 4.1 mi. two 12" low pressure polyethylene, (buried) 400' X-C line from FDR No. 150B to top of impoundment (two 10" high pressure steel)
Excess Mine Adit Water Handling	(1) 12" polyethylene line buried adjacent to road from adit to mill, 6,700' (2) From mill 12" buried line parallels slurry line to Sec. 15, then parallel's FDR No. 150 to MT Hwy 200, then would parallel hwy for 500', would cross and parallel road to Clark Fork for 6.9 mi.	(1) Buried from adit down ridge 3,000' to mill (2) 12" steel excess water line parallels slurry line to intersection of new FDR No. 150, then parallels FDR No. 150 to south section line of Sec. 28, remainder same as Alternative II, 6.9 mi.	(1) N/A (2) Follows same route as Alternative III except starts at confluence mill site, 6.1 mi.
Transmission Line 230 kV Pole Line	Parallels existing 230 kV line from switchyard. Would cross hwy, then parallel newly constructed & reconstructed FDR No. 150 to mill, 6.9 mi.	Starts as in Alternative II, then parallels proposed FDR No. 150 & reconstructed FDR No. 150 to mill **6.85 mi. total length**	Same as Alternative III except only goes to confluence mill site 5.5 mi.
Conveyor Line	From adit to mill 2,500' by 42" wide	Same as Alternative II	All within mill site
Wilderness Ventilation Adit	On approx 57% slope, 1,600' NE of ridge @ elev of 5,760'	In the cliffs on approx. 150% slope, 400' NE of ridge @ elev of 6,700'	Same as Alternative III
Rail Load-out Location	At Herford siding	Miller Gulch	Same as Alternative III
Tailings Impoundment Starter Dam Borrow	735,000 cu. yards of borrow from within impoundment & 2 borrow sites (27.2 acres)	Same as Alternative II	735,000 cu. yards of borrow from within impoundment, waste rock from adit construction and borrow site 3 (27.2 acres)

TABLE 2-11.
ASARCO Rock Creek Project Alternative Comparison (Cont'd)

Project Facility or Feature	Alternative II ASARCO Proposal	Alternative III Proposed Project w/Mitigations	Alternative IV Modified Project w/Mitigations
Soil Storage			
(1) Exploration Adit	(1) North end; 1.2 ac; 8,757 cy	(1) Same as Alternative II	(1) Same as Alternative II
(2) Support Facilities	(2) Adjacent storage; 1.3 ac; 4,193 cy	(2) Same as Alternative II	(2) Same as Alternative II
(3) Tailings Impoundment and associated components	(3) Impoundment, borrow areas, pump station S-1 parallel to powerline; 11.3 ac; 248,086 cy S-2 northeast corner near borrow site B-2; 8.3 ac; 179,649 cy Roads (access, haul); adjacent storage; 5.4 ac; 9,290 cy Water control structures; adjacent storage; 9.2 ac; 17,141 cy	(3) Similar to Alternative II but stockpiles S-1 and S-2 expanded to handle additional volume: S-1 increases to 18.1 ac; 563,227 cy S-2 increases to 16.4 ac; 549,598 cy	(3) Same as Alternative II
(4) Transportation Corridor	(4) Stored adjacent to each component; total 29.3 ac; 56,371 cy	(4) Soil stored adjacent to each component only when salvage showed clear benefit to revegetation and would not result in excessive disturbance	(4) Same as Alternative III
(5) Water Treatment Facility	(5) Adjacent storage; 10.0 ac; 32,269 cy	(5) Same as Alternative II	(5) Same as Alternative II
(6) Mill Facilities	(6) S-3 south end; 2.5 ac; 42,271 cy S-4 north end; 3.4 ac; 56,910 cy	(6) Similar to Alternative II but stockpiles S-1 and S-2 expanded to handle additional volume: S-3 increases to 78,921 cy S-4 increases to 93,560 cy	(6) New location at confluences mill site: north-center; 4.1 ac; 151,665 cy
(7) Mine	(7) N/A	(7) Similar to Alternative II but new waste rock dump location has salvageable soil; stored along toe/sides of 2 small waste rock dumps; 9,681 cy	(7) Included in mill facilities (6) above
	Total cubic yards: 655,949	**Total cubic yards: 1,367,649**	**Total cubic yards: 1,313,554**
Mine Adit Water Treatment	Treatment setting and flocculation with a passive biotreatment and ion exchange system	Same as Alternative II	Same as Alternative II
Exploration Adit Water Treatment	Pressure filtration, oil skimmer, and a passive biotreatment and ion exchange system	Same as Alternative II	Same as Alternative II

Notes: X-C means cross country; N/A means not applicable; ROW means right-of-way; cy means cubic yards.

TABLE 2-12.
ASARCO Rock Creek Project Reclamation Comparison

Reclamation Feature or Component	Alternative I No Action	Alternative II ASARCO's Proposal	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations
TAILINGS IMPOUNDMENT				
Soil depth (average)	30 inches	Salvage depth - 11.0 inches Respread depth - 9.5 inches	Salvage Depth: Lift 1 - 11.0 inches Lift 2 - 14.5 inches Respread depth - 24 inches	Same as Alternative III
Interim[1] revegetation on dam faces	N/A	None	Interim revegetation with G/F[2] until reshaping completed	Same as Alternative III
Final revegetation on dam faces	N/A	Phased during construction with seeded G/F/S[2] Containerized S/T[2] years 34-35	Initiated after 7th year of construction. Phased in years 8-33 with seeded G/F and containerized S/T[2] every 3-4 years	Same as Alternative III Same as Alternative III
Planting plan	N/A	Alternating strips for drill-seeded species (8-feet wide) and containerized species (2- to 4-feet wide), 6-foot spacing for trees	Plans replicate naturally occurring species, densities, and distributions	Same as Alternative III
Postmining topography	N/A	Smooth planar faces and abrupt transitions to adjacent topography	Reshaping and grading of faces (years 7-33) every 3-4 years Smooth transitions from human made to natural land forms	Same as Alternative III
Associated facilities: soil stockpiles, roads, pipeline corridors	N/A N/A	Interim reveg with G[2] Final reveg with seeded G/F/S[2] and containerized T[2] on stockpile sites and roads	Same as Alternative II Final reveg with containerized S/T on stockpile sites as depleted; roads and pipeline corridors immediately	Same as Alternative II Same as Alternative III
MILL SITE, PORTAL, AND ASSOCIATED FACILITIES				
Soil depth (average)	21 inches	Salvage depth - 21 inches Respread depth -11 inches	Salvage depths: Lift 1 - 11 inches Lift 2 - 25 inches Respread depth - 24 inches (soil also placed on rock dumps)	Salvage depth: Lift 1 - 19 inches Lift 2 - 6 inches Respread depth - 24 inches
Final reclamation	N/A	Revegetation with seeded G/F/S[2] and containerized T[2] after year 33	Revegetation with seeded G/F and containerized S/T[2] after year 33	Revegetation with seeded G/F and containerized S/T after year 4 on pad faces Revegetation on pad surface after year 35
Planting plans	N/A	Alternating strips for drill-seeded species (8-feet wide) and containerized species (2- to 4-feet wide), 6-foot spacing for trees	Plans replicate naturally occurring species, densities, and distributions	Same as Alternative III

[1] Interim - a temporary grass seed mix used primarily for soil stabilization that would be replanted with a final seed and/or planting mix.

[2] G/F/S/T - Grasses/Forbs/Shrubs/Trees specified for revegetation; see **Appendix G** for seeding and planting proposals.

[3] Same G/F seed mix proposed for interim and final revegetation on exploration adit.

N/A = not applicable

TABLE 2-12.
ASARCO Rock Creek Project Reclamation Comparison (Cont'd)

Reclamation Feature or Component	Alternative I No Action	Alternative II ASARCO's Proposal	Alternative III Project With Mitigations	Alternative IV Modified Project w/Mitigations
Postmining topography	N/A	Abrupt transition to adjacent topography at mill site and portal	Reshaping and grading of mill site and portal area (year 34) to more natural appearing forms Smooth transitions from human made to natural land forms	Same as Alternative III for portal. Shaping of mill pad faces in years 1-4 Reshaping of pad surface after year 34
WASTE ROCK DUMP				
Soil depth (average)	0 inches	Salvage depth - 0 inches Respread depth - 11 inches (soil from mill site area)	Salvage depth: Lift 1 - 24 inches on ≤ 40% slopes. Respread depth: 24 inches with two smaller dumps (additional soil from mill site)	N/A
Final reclamation	N/A	Revegetation with seeded G/F/S^2 and containerized T^2 in year 35	Revegetation with containerized S/T^2 in year 5	N/A
EXPLORATION ADIT				
Soil depth (average)	Average 9.2 inches over 7.7 acres	Salvage depth: From 4.24 acres: Lift 1 - 6 inches (1.98 acres) and 5 inches (2.26 acres) Lift 2 - 24 inches (1.98 acres) Respread depth (1-2 lifts) - average 13 inches on 4.9 acres (adit, dump top, and part of dump face) Remaining 1.4 acres of face left as talus-like rock	Salvage depths same as Alternative II Respread depth similar to Alternative II but areas respread would coincide with planting plans	Same as Alternative III Respread depth similar to Alternative II but areas respread would coincide with planting plans
Revegetation	N/A	Seeded immediately after construction with G/F^3 on access road, soil stockpiles, and surface water control features Additional G/F^2 seeding as features are recontoured (as soon as possible after completion of evaluation work)	Interim seeding with G/F^2 on access road, ditches, and soil stockpiles Final seeding of disturbed areas with containerized S/T^2	Same as Alternative III
Planting plans	N/A	Uniform G^2 cover on 4.9 acres with 1.4 acres left as talus	Pockets and edges of disturbed areas planted with S/T^2 to achieve mosaic appearance similar to adjacent slopes	Same as Alternative III
Postmining topography	N/A	Face of dump graded to 2H:IV slope; bench approximately 100-feet wide retained	Dump recontoured to approximate existing contours with no bench	Same as Alternative III

[1] Interim - a temporary grass seed mix used primarily for soil stabilization that would be replanted with a final seed and/or planting mix.

[2] G/F/S/T - Grasses/Forbs/Shrubs/Trees specified for revegetation; see **Appendix G** for seeding and planting proposals.

[3] Same G/F seed mix proposed for interim and final revegetation on exploration adit.

N/A = not applicable

compares the reclamation planning aspects of each alternative. These alternatives are described in detail earlier in this chapter. A detailed discussion of the alternatives' impacts is contained in Chapter 4. The following section summarizes the impacts, their magnitude, and level of significance, and discusses how impacts relate to the issues that drove alternative development.

Consequences of the Proposed Project and Alternatives

All alternatives would result in impacts of varying magnitude, duration, and importance to resources with regards to the eight issues disscussed under Identification of Issues. Howver, as proposed, all action alternatives for the Rock Creek Project would result in potentially significant or significant impacts to environmental resources specified in six of the issues. They are briefly summarized below:

Issue 1: Effects on quantity and quality of Montana and Idaho surface and ground water resources.

Effects are predicted to impact

- aquatic invertebrates from sediment and nutrient loads (alternative II and III);
- surface water quality from spills and pipeline ruptures (all action alternatives); and
- wilderness lake water levels and aquatic life from remote possibility of subsidence (all action alternatives).

Issue 2: Effects on fish and wildlife habitat and current and proposed threatened and endangered species.

Effects are predicted to impact

- grizzly bear habitat due to lost and reduced effective habitat (all action alternatives);
- neotropical migrant birds due to direct and indirect loss of old growth habitat (all action alternatives);
- sensitive animal species (harlequin duck, lynx, fisher and wolverine) due to loss, degradation and fragmentation of habitat (all action alternatives);
- sensitive aquatic species (bull and westslope cutthroat trout) due to increased sediment and increased winter breeding with non-native species (alternatives II and III); and

- pileated woodpecker due to loss of up to 21 percent of old-growth habitat (all action alternatives).

Issue 3: Stability of the tailings impoundment.

Effects from impoundment failure are predicted to impact

- surface water quality and aquatic life in lower Rock Creek and Clark Fork River if failure occurred (all action alternatives).

Issue 5: Effects on old growth ecosystems.

Effects are predicted to

- destroy 91 to 208 (depending on the alternative) acres of old growth and reduce habitat quality and effectiveness as well as biological diversity (all action alternatives).

Issue 6: Effects on Waters of the U.S. and wetlands.

Effects are predicted to impact

- Up to 9.6 acres of Waters of the U.S. and wetlands and decrease functions and values until mitigation sites, up to 13.8 acres (depending on the alternative), were established (all action alternatives).

Issue 8: Effects on aesthetic quality, including noise, visual, and wilderness experiences.

Effects are predicted to impact

- mountain goats, travelers on FDR No. 150, and residents at Hereford (Alternative II only) due to increases in sound levels from mine activities and traffic respectively (all action alternatives);
- visual quality of Rock Creek and Clark Fork Valley and ability to comply with Forest Service standards due to size, shape, color, texture and contrast of mine facilities with surrounding landscapes and the amount of time needed for reclamation/revegetation to mitigate impacts (all action alternatives); and
- solitude of wilderness users near the ventilation adit due to high visibility and elevated noise levels (alternative II).

Table 2-13 and the following descriptions provide a more detailed summary comparison of the effects of all alternatives with regards to all eight significant issues identified earlier in this chapter.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts[1]

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Water Resources				
Surface water quality	Except for minor increases in sediment, existing surface water quality would be maintained.	Minor increases in metals, nitrogen, ammonia, and total dissolved solids concentrations in Clark Fork River from treated discharges during operations.	Same as Alternative II	Same as Alternative II
		Nitrogen loads would be temporarily increased in Rock Creek and the West Fork during mine construction and would impact aquatic invertebrates and algae in the short term.	**Same as Alternative II**	**Similar to Alternative II but the aquatic life in West Fork of Rock Creek above the confluence mill site would not be affected by increased nitrogen from mine construction, or waste rock dumps. The 300' buffer zone around confluence mill site would reduce nitrogen loading to Rock Creek.**
	Sediment-loading for Rock Creek may temporarily increase due to construction of roads and land clearing for timber sales.	Sedimentation would be reduced because timber road construction for NFS lands in the Rock Creek drainage may be limited due to project increased open road densities.	Same as Alternative II	Same as Alternative II
		Impacts from materials from spills and pipeline ruptures potentially could affect water quality in Rock Creek and the Clark Fork River.	**Same as Alternative II except the potential for material from spills and pipeline ruptures to reach the main stem of Rock Creek is reduced.**	**Same as Alternative II except potential for spills and pipeline ruptures in West Fork of Rock Creek would be eliminated.**
Ground water quality	Ground water quality would be similar to existing quality.	Ground water quality standards for nitrates and dissolved manganese would be exceeded within an approved mixing zone during construction and operation of tailings impoundment. Downgradient ground water quality would not be affected beyond the mixing zone as a result of a ground water extraction and pump-back system.	Similar to Alternative II, except impoundment seepage would be reduced by using excavated clays to seal permeable contact zones. The technical panel reviewers for impoundment design would investigate the use of seepage reduction techniques (which may include synthetic or clay liners) to further minimize seepage if acid-base accounting of waste rocks indicated potential for acid drainage.	Same as Alternative III.
Surface water quantity	Appropriated water would continue to be withdrawn from surface water.	Surface flow in Miller Gulch would be reduced during operations.	Same as Alternative II.	Same as Alternative II.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Ground water quantity	Ground water well production from appropriated sources would be similar to existing production.	Possible decrease in static water levels in wells not in Clark Fork alluvium and spring flow downgradient of Miller Gulch during operation.	Same as Alternative II.	Same as Alternative II.
		Portal plugging and subsequent mine flooding may generate downgradient springs	Same as Alternative II.	Same as Alternative II.
Wilderness lakes	Wilderness lakes would continue to experience natural and seasonal water level fluctuations.	**The potential for subsidence is remote. Impacts would be potentially significant.**	**The potential for subsidence, although remote, would be reduced by additional rock mechanics studies and a subsidence control plan. Impacts would be potentially significant.**	**Same as Alternative III.**
		Aquatic life and wetlands associated with Cliff and/or Copper lakes could be significantly impacted if subsidence occurred.	**Potentially significant, short-term impacts to wetlands and aquatic life associated with Cliff and/or Copper lakes would be mitigated in accordance with a mitigation plan if subsidence occurred.**	**Same as Alternative III.**
Wildlife Habitat and Threatened & Endangered (T&E) Species				
Grizzly bears	Continued availability of spring and fall grizzly bear habitat.	**Direct physical loss of 584 acres of habitat. Habitat effectiveness would be reduced on an estimated 3,560 acres. This would have a potentially significant impact on grizzly bear habitat.**	**Direct physical loss of 609 acres of habitat. Habitat effectiveness would be reduced on an estimated 3,695 acres. This would have a potentially significant impact on grizzly bear habitat.**	**Direct physical loss of 542 acres of habitat. Habitat effectiveness would be reduced on an estimated 2,390 acres. This would have a potentially significant impact on grizzly bear habitat.**
	Slight increase in habitat effectiveness due to road closures.	The KNF would need to close 4.4 miles of roads to reduce open road densities to meet the 0.75 miles of open road per square mile standard for bear analysis areas.	Open and total road densities would be reduced. KNF would need to close 4.5 miles of roads to reduce open road densities to meet the standard.	Same as Alternative III.
		Increased mortality from road kills, poaching, and destruction of nuisance bears.	Similar impacts as Alternative II but somewhat reduced due to additional mitigations.	Same as Alternative III.

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[1] **All significant or potentially significant impacts are in bold text. For more detail, see Chapter 4.**

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Other T&E species	Bald eagle use would continue to increase.	Increases in road-killed deer could slightly and indirectly increase mortality risk of bald eagles along MT Hwy. 200, FDR No. 150, and along the train tracks near the Hereford siding. Loss of one nesting pair of eagles could significantly affect recovery of the species in the area.	Increases in road-killed deer and associated bald eagle mortality risk along MT Hwy. 200 is less than Alternative II because of rerouting concentrate haulers to the Miller Gulch rail load-out along FDR No. 150B and daily removal of road-killed animals.	Same as Alternative III.
	Migratory peregrine would continue to use the Clark Fork River drainage.	Similar to Alternative I.	Same as Alternative II.	Same as Alternative II.
Big game animals	Minor changes in habitat or activities of big game animals; security could be improved as open road densities were reduced.	Increased potential for animal-vehicle collisions.	Similar to Alternative II.	Similar to Alternative III.
		Minor loss of habitat for game species including travel corridors, riparian areas and a few small bull elk wintering areas.	Similar to Alternative II.	Habitat loss associated with the mill in the upper West Fork of Rock Creek would be shifted to the confluence mill site.
		Displacement and possible increased mortality of animals due to increased human use and activities (including hunting and poaching).	Similar to Alternative II.	Similar to Alternative II.
Neotropical migrant birds	Minor changes in forested habitat or activities of neotropical migrant birds.	Direct and indirect loss of old growth, riparian, and wetland habitats would affect songbirds in those areas. Potential loss of individual birds.	Same as Alternative II.	Same as Alternative II.
Sensitive animal species	Stability of harlequin duck population in lower Clark Fork would remain vulnerable.	Breeding harlequin ducks affected by and habitat degraded by increased noise level, human disturbance, and habitat alteration. This could result in loss of harlequin reproduction on Rock Creek. Loss of Rock Creek breeding area would be significant to security of the lower Clark Fork harlequin subpopulation.	Impacts to harlequin duck habitat lessened with relocation of FDR No. 150 out of the riparian area but remain potentially significant and similar to Alternative II.	Similar to Alternative III.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Sensitive animal species (Cont'd)	Habitat for lynx, fishers, and wolverines would continue to degrade as fragmentation and habitat degradation continued.	**Loss, degradation, and fragmentation of important fisher, lynx, and wolverine habitat, especially old growth, riparian areas and travel corridors could displace animals and/or increase stress and mortality risk.**	**Similar to Alternative II.**	**Similar to Alternative II.**
		Loss of habitat and potential increases in hunting, trapping, poaching, and traffic collisions would add to the overall decline of fisher, lynx, and wolverine security and habitat in the Cabinet Mountains.	**Similar to Alternative II.**	**Similar to Alternative II.**
Sensitive aquatic species	**Sediment impacts from private and KNF timber sales and other developments could have a significant impact on aquatic resources.**	**Increased sediment in West Fork and mainstem Rock Creek would significantly decrease emergence success of bull and cutthroat trout fry.**	**Modifications and mitigations would reduce the amount of sediment impacting Rock Creek spawning habitat and bull and cutthroat trout.**	Sediment impacts to bull and westslope cutthroat trout would be minimized in the West Fork of Rock Creek. The 300 ft. buffer around the confluence mill site would reduce sedimentation impacts downstream.
	Natural changes in aquatic habitat are expected, marginal threat to long-term survival for Cabinet Gorge bull trout stock and long-term risk of loss of cutthroat population due to introgression.	**Reduced bull trout habitat in Rock Creek could significantly impact Cabinet Gorge bull trout.**	**Reduction of existing sediment sources in Rock Creek and Bull River drainages would improve the status of bull trout and cutthroat populations in Rock Creek, and bull trout in Cabinet Gorge Reservoir.**	Similar to Alternative III but 300-ft. buffer around the confluence mill site would further reduce sediment impacts to bull and cutthroat trout in mainstem Rock Creek and bull trout in Cabinet Gorge Reservoir.
		Potential increase in non-native fish species and interbreeding with native sensitive species (westslope cutthroat trout and bull trout).	Risk of interbreeding and non-native fish species increase would be reduced due to sediment mitigations.	Similar to Alternative II.
Plant species of special concern	Eighteen populations of plant species of special concern within the permit area would remain undisturbed.	Twelve populations of 5 species of special concern would be eliminated, including the 3 known populations of crested shield-fern.	Twelve populations of 5 species of special concern, including 2 populations of crested shield-fern, would be eliminated if they cannot be avoided during construction.	Eleven populations of 5 plant species of special concern, including 1 population of crested shield-fern, would be eliminated if they cannot be avoided during construction.

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[1] **All significant or potentially significant impacts are in bold text. For more detail, see Chapter 4.**

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Mountain goats	Some of the Rock Peak goat herd could be affected by the Montanore mine which could result in stress or displacement of some goats. If goats are displaced, an increase of goats in vicinity of Rock Creek in summer/transitional ranges could result.	Project-related noises would impact approximately 8,492 acres of goat habitat at various times over life of project.	Similar to Alternative II except that noise-related impacts from the ventilation adit would be reduced by 450 acres once adit was constructed due to its relocation and sound mitigations.	Similar to Alternative III except that less habitat in the upper West Fork of Rock Creek would be impacted or made less effective due to the mill relocation.
		Noise-related impacts, perceived/actual human presence, and displacement could result in prolonged, higher stress levels in both displaced and remaining goats. The cumulative effects of the Montanore and Rock Creek projects could result in a decline in individual and/or herd health and numbers.	Similar to Alternative II.	Similar to Alternative II. Noise-related impacts (especially during construction) and mine operations would be closer to critical winter range at Rock Meadows in the East Fork of Rock Creek drainage, potentially increasing stress to wintering goats.
		Increased mortality risk due to increased human use of the area by recreationists, hunters, and poachers.	Similar to Alternative II, but additional road closures would reduce some human use and associated disturbances.	Similar to Alternative III.
Pileated woodpecker	Habitat availability to sustain local populations of pileated woodpeckers would remain below recommended biologically sound levels.	Loss of 21% of effective old growth would potentially significantly affect sustainability of local pileated woodpecker populations.	Loss of 15% of effective old growth would potentially significantly affect sustainability of local pileated woodpecker populations.	Loss of 9.3% of effective old growth would potentially significantly affect sustainability of local pileated woodpecker populations.
Impoundment Stability	No tailings impoundment would be constructed, therefore no risk of failure.	Risk of impoundment failure would be possible but remote.	Modified design and construction details as well as a technical panel review of the design would further reduce the risk of impoundment failure.	Same as Alternative III.
		Impacts from an impoundment failure to surface waters and aquatics would be potentially significant.	**Same as Alternative II.**	**Same as Alternative II.**

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Socioeconomics				
Employment	Substantial employment growth would come from service sector jobs.	The project would directly generate up to 433 construction and 355 mine operation related jobs and about 140 indirect jobs. Growth of service sector jobs would be hindered by resource extraction dependent employment.	Same as Alternative II.	Similar to Alternative II but Alternative IV would directly generate up to 350 construction workers, 355 mine operation workers and about 150 indirect jobs.
	Employment would continue at existing trends.	The project would generate an employment boom-bust cycle between mine construction and operation phases.	Same as Alternative II.	Mine construction employment scheduling could reduce peak construction to levels closer to mine operation employment and would moderate the boom-bust cycle.
Population	Substantial population increase at predicted rate.	Project employment and associated immigration would result in an increase of approximately 4% in Sanders County, and less than 0.4% in Bonner and Lincoln counties during construction. Mining operations would result in an increase of less than 3% in Sanders County and less than 0.15% in Bonner and Lincoln counties. Population increases in Sanders County could be potentially significant.	Similar to Alternative II.	Both mine construction and operations and the associated immigration would result in an increase of less than 3% in Sanders County and less than 0.15% in Bonner and Lincoln counties.
Income	Moderately increasing personal income.	The generation of an annual personal income of $9.6 million and indirect income of $1.5 million would increase three-county personal income by 2 percent.	Similar to Alternative II.	Similar to Alternative II.
Housing	Existing housing shortages would continue.	Increased housing shortage during mine construction could result in construction of mobile-home court or apartment building. New homes would be built during mine operations resulting in a potential surplus after mine closure.	Similar to Alternative II.	Similar to Alternative II.
Community Services	Moderate increases in demand for already burdened community services.	Increased need for law enforcement and fire protection personnel.	Same as Alternative II.	Similar to Alternative II but smaller effects during the construction period due to fewer immigrating people.
		Classroom capacities and school accreditation standards may be exceeded in some communities during construction.	Same as Alternative II.	Similar to Alternative II but smaller effects during the construction period due to fewer immigrating people.
		Some community water and/or wastewater treatment facilities may be unable to absorb additional users.	Same as Alternative II.	Similar to Alternative II but smaller effects during the construction period due to fewer immigrating people.

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[1] All significant or potentially significant impacts are in **bold text**. For more detail, see Chapter 4.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Community Services (Cont'd)		ASARCO's Hard Rock Impact Plan could help mitigate financial costs associated with resolving these impacts.	Same as Alternative II.	Same as Alternative II.
Fiscal	Revenues and government expenses would continue along existing trends.	Increased needs for services would impact Sanders County's ability to finance those services.	Same as Alternative II.	Similar to Alternative II.
		Increased property and income tax revenues.	Same as Alternative II.	Similar to Alternative II.
Land use	Land use patterns and changes would continue at existing rates and locations.	About 400 acres at impoundment site would be unusable for most existing land uses.	Same as Alternative II	Same as Alternative II.
		Approximately 2,893 acres of private lands needed for grizzly bear mitigation would be removed from residential and commercial land uses.	Approximately 3,011 acres of private lands needed for grizzly bear mitigation would be removed from residential and commercial land uses.	Similar to Alternative III except that only 2,303 acres of private lands would be removed from future development.
Old Growth Ecosystem (does not include replacement growth)	Approximately 7% of Compartment 711 would remain in old growth habitat. This percentage would change due to natural succession and/or natural occurrences, (e.g., fire).	**About 208 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 5.5% of Compartment 711.**	**Similar to Alternative II but 154 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 5.9% of Compartment 711.**	**Similar to Alternative II but 91 acres of effective old growth habitat would be lost or degraded. Effective old growth habitat would decline to 6.4% of Compartment 711.**
	Abundance of current old growth habitat would remain below the recommended levels to provide for long-term maintenance of viable old-growth-associated species in Compartment 711.	**Biological diversity would be reduced and long-term occurrence and maintenance of old-growth-dependent species would be unlikely.**	**Similar to Alternative II.**	**Similar to Alternative II.**

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Waters of the U.S. & Wetlands				
Wetlands & riparian zones	Wetland and riparian zones could be disturbed by timber sale roads and development of private lands.	**A total of 9.6 acres of Waters of the U.S. and wetlands would be disturbed by the project.**	**About 7.7 acres of Waters of the U.S. and wetlands would be affected.**	**Less than 6.4 acres of Waters of the U.S. and wetlands would be disturbed.**
		Functions and values may decrease until the 13.8 acres of Waters of the U.S. and wetland mitigation sites were established.	**Similar to Alternative II but only 10.5 acres of Waters of the U.S. and wetland mitigation sites have been identified.**	**Same as Alternative III.**
Transportation				
Public access	Public access for hunting, fishing, hiking and other recreational activities would remain the same.	There may be delays and temporary road closures during road construction and reconstruction.	Similar to Alternative II.	Similar to Alternative II.
		N/A	FDR No. 150B between Engle Creek and Government Mountain Road west would be restricted to mine-related traffic.	Same as Alternative III.
		Paving of FDR No. 150 and widening of FDR No. 2741 would improve year-round public access to the CMW and for general recreational activities.	Same as Alternative II.	Public access from FDR nos. 2741 and 150 above the confluence of the East and West forks of Rock Creek would remain the same as Alternative I.
Traffic safety	Traffic volumes and accident risk would grow and/or decline with population changes, timber sales, and development of private lands.	The average daily traffic (ADT) for Montana Hwy. 200 would increase by 71 percent during construction and by 38 percent during mine operation. The ADT for FDR No. 150 also would increase by 2,800 percent and 1,440 percent, respectively. This would increase the chances for traffic-related accidents on these roads.	ADT would remain essentially the same as in Alternative II. Any carpooling and busing would reduce ADT.	Similar to Alternative III, except that ADT on FDR nos. 150 and 2741 above the confluence of the East and West forks of Rock Creek after exploration was completed would be similar to Alternative I.
	Traffic to Hereford rail siding and Government Mountain (FDR No. 150) would remain at existing levels.	Slow moving ore concentrate trucks travelling to and from the Hereford rail load-out would be turning onto and off the Montana Hwy. 200. This would create additional hazards to higher speed highway traffic and residential traffic at Hereford.	Ore concentrate truck traffic would be eliminated from Montana Hwy. 200. ADT on FDR No. 150B from Engle Creek to the Miller Gulch rail load-out would show a slight increase.	Same as Alternative III.

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[1] All significant or potentially significant impacts are in **bold text**. For more detail, see Chapter 4.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Traffic safety (Cont'd)		Road alignment of FDR No. 150 and MT Hwy. 200 intersection could increase potential for accidents.	FDR No. 150 and Montana Hwy. 200 intersection location complies with state standards and would not increase potential for accidents.	Same as Alternative III.
Aesthetic Quality				
Noise	Existing noise levels in the Rock Creek drainage and Clark Fork Valley would be maintained except for changes associated with timber sales and private land development.	Long term noise-related impacts to mountain goats (see above).	Long-term impacts to mountain goats would be somewhat reduced (see above).	Similar to Alternative III.
		Blasting during adit construction would generate sounds up to 125 dBA within 900 feet of the blast and 60-80 dBA within the Clark Fork Valley and the CMW. Construction equipment would generate sounds up to 110 dBA within 50 feet.	Similar to Alternative II except that sound mitigations to construction equipment could reduce noise levels.	Same as Alternative III except that moving the mill to the confluence would increase the buffer between the mill/mine operations and the CMW to 1.25 miles. Noise levels would be about 35 dBA at the CMW boundary.
		Mine operation noise levels of 52-62 dBA are lower than construction noise levels but still greater than premine conditions and would generally be inaudible in Clark Fork Valley.	Implementation of sound mitigations (e.g. reduce backup beeper volumes, dampen exhaust and intake fan, and retain vegetative buffers) would reduce operation noise levels.	Same as Alternative III.
		Traffic related noises would significantly increase on FDR No. 150 from 30 to 70 dBA.	Similar to Alternative II.	Similar to Alternative II.
		Activities at the Hereford rail load-out facility would generate noise up to 87 dBA daily between 8 a.m. and midnight. This would increase noise levels to residences in the area.	Noise-related impacts to Hereford residences would be avoided by moving the rail load-out to the Miller Gulch site. Sound levels at Miller Gulch would be similar to those at Hereford (Alternative II), but there are no nearby residences that would be impacted.	Same as Alternative II.
		Ventilation fans would operate continuously at about 123-96 dBA and would be heard at about 45 dBA up to a mile away (450 acres) for the last 15-20 years of mine operation. This would significantly affect the solitude expected by people visiting the area of the CMW near the adit.	Relocation of the ventilation adit and sound mitigations for the ventilation fans would reduce the noise level to 30 dBA within 100 feet of the adit. This reduces the impact to CMW visitors.	Same as Alternative III.

TABLE 2-13.
Summary Comparison of Project Alternatives Impacts (Cont'd)

ENVIRONMENTAL ISSUE	PROJECT ALTERNATIVES			
	I (No Action)	II (ASARCO's Proposal)	III (Project With Mitigations)	IV (Modified Project With Mitigations)
Scenic quality	Visual character of the Rock Creek drainage and the Clark Fork Valley would be retained.	**Significant impacts to Rock Creek drainage and Clark Fork Valley from project features during construction and operation.**	**Significant impacts somewhat reduced by painting or staining mill facilities and immediate revegetation of cut slopes and waste rock dumps.**	**Similar to Alternative III except impacts at confluence mill site further reduced by visual buffer along FDR No. 150 and immediate revegetation of mill pad face following construction.**
		Impoundment visibility would significantly impact travelers on MT Hwy. 200 due to lack of screening and postponement of planting trees until after mine closure and topographic changes.	Impoundment visibility along MT Hwy. 200 reduced by planting vegetative screen and concurrent planting of trees and shrubs after year 7 of impoundment construction.	Same as Alternative III.
		Impoundment surface highly visible in background for CMW users on high trails and peaks.	Similar to Alternative II, but long-term visibility reduced due to changes in revegetation plan.	Same as Alternative III.
		Utility corridor visible to people using FDR No. 150.	Similar to Alternative II.	Same as Alternative II.
	Forest Plan Visual Management System (VMS) and Visual Quality Objectives (VQO) would be used for future timber sales or other KNF management activities.	**The proposed VMS VQOs would be impossible to achieve during mine life and/or VQO time frames.**	**Same as Alternative II.**	**Same as Alternative II.**
		The impoundment surface could potentially never meet Retention VQO standards.	**Additional reclamation requirements would increase the likelihood the impoundment surface would achieve VQO standards within several decades.**	**Same as Alternative III.**
		The impoundment face, mill site and utility corridor might achieve prescribed VQOs several decades after mine closure.	**Additional plantings for screening, concurrent planting of trees and shrubs on impoundment face after year 7 of construction, and other additional reclamation requirements would shorten the amount of time needed for mine facilities to achieve VQO standards, but it would still take decades.**	**Similar to Alternative III, except that the elimination of the waste rock dump, immediate planting of the mill pad face, and the visual buffer would further help the site achieve VQO standards after several decades.**
Wilderness	Current wilderness experience remains unaffected.	**The ventilation adit would be highly visible and audible to recreationists using the CMW within 2,500 of the adit. The adit would significantly affect the wilderness experience of those users (see Noise above).**	Placing the ventilation adit in a more vertical slope could increase its visibility, but would reduce the area of disturbance around the adit. Additional reclamation requirements would dramatically reduce the visual impacts of the adit after mine closure.	Same as Alternative III.
			Sound mitigations would reduce the noise-related impacts to humans and goats to a 100-foot radius around the adit.	Same as Alternative III.

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[1] All significant or potentially significant impacts are in bold text. For more detail, see Chapter 4.

Changes in Water Resources

Surface and Ground Water Quality. The Agencies analyses are based on assumptions that may vary from actual mining, climate, and site conditions during operation and reclamation and cannot be known completely in advance. These assumptions are reasonable, conservative, and protective of water quality. There are several factors that could affect predicting the levels of impacts to surface and ground water quality for nutrients, certain metals, and sediment. These include actual concentrations of nitrogen in the blasting media used, the number of explosive misfires or incomplete reactions, actual waste rock and ore geochemical content, particle size of waste rock and tailings, actual infiltration capacity of the mill and impoundment sites, rainfall and temperature conditions, actual streamflow, and efficiency of the proposed water treatment facility. Uncertainties in the Agencies' analyses are discussed in detail in Chapter 4.

All three action alternatives would result in minor (Clark Fork) to moderate (Rock Creek) changes in existing surface water quality. The concentrations would be unmeasurable after dilution with Clark Fork River. This would be due in part to the proposed filtration and treatment of discharged water; concentrations of sediment and nutrients would be reduced. It is also due to the dilution afforded by the relatively higher flow of the Clark Fork River.

Water treatment would be required as long as water being discharged from the impoundment and adits did not meet water quality standards. If the mine adits were not sealed, when mine adit waterquality met state water quality standards, it could be discharged to Rock Creek (if approved by DHES) through a constructed channel. If the adits were sealed after mine closure, mine water eventually would discharge into bedrock, and possibly out through springs whose location cannot be determined at this time.

Construction of the mill pad, roads, and waste rock dumps would temporarily increase the concentrations of sediment and nitrogen loads of Rock Creek for alternatives II and III. The concentration of total suspended solids probably would not increase more than 7 mg/L (see Chapter IV, Hydrology). The concentration of nitrogen cannot be estimated with certainty and would depend upon the amount of nitrogen contamination of the waste rock, climate, infiltration beneath the mill pad, starter dams, and waste rock piles, and amount of surface runoff circumventing containment barriers and diversion structures. Aquatic invertebrates could be significantly impacted from increased nitrates in the short term. Impacts to aquatic plant communities or algae would be potentially significant in the short term from increases in nitrogen. Alternative III mitigations would reduce sediment loads in Rock Creek lessening the impacts to aquatic life. For Alternative IV, suspended sediment produced from construction of the mill facility, and residual nitrogen from blasting would not effect the West Fork of Rock Creek because the mill would be located farther downstream, there would be less road construction/reconstruction, and there would be no waste rock dump. The 300-foot stream buffer around the confluence mill site would further reduce sediment impacts to lower reaches of Rock Creek.

Impacts to aquatics and fisheries from spills and/or pipeline ruptures would be potentially significant for all action alternatives. The potential for spills to reach surface waters would be somewhat reduced due to consolidation of utility and road corridors and the relocation of the lower portion of FDR No. 150 away from Rock Creek. Relocating the mill to the confluence of the East and West forks of

Rock Creek would eliminate the potential for materials from spills and pipeline ruptures to reach the West Fork of Rock Creek.

Changes in ground water quality for all three action alternatives would, for the most part, be restricted to an approved ground water mixing zone that must be approved by DHES. Only nitrates and dissolved manganese would exceed Montana's standards (manganese exceeds the standard in ambient ground water). Clays removed for dam stability purposes in alternatives III and IV would be used to seal higher permeable areas such as the colluvium at the north end of the impoundment. An engineered perimeter drain and ground water extraction well system would collect and pump seepage back to the tailings impoundment and prevent changes in ground water quality outside of the mixing zone for all action alternatives. Discharge of tailings impoundment seepage to Rock Creek, Miller Gulch, and the Clark Fork River would be nearly eliminated. Frequent monitoring from associated compliance wells would be required to determine the effectiveness of the system and whether or not additional pump-back wells would be needed.

ASARCO's water monitoring plan would be expanded for alternatives III and IV and would include a Monitoring Alert Levels and Contingency/Corrective Action Plan. This plan would ensure early detection of potential environmental degradation or impairment and would focus primarily on the protection of surface and ground water resources. The intent of this additional plan would be to prevent pollution and other problems before they occurred. The water monitoring plan would be coordinated with the fishery/aquatics monitoring plan and wetlands mitigation and monitoring plans.

Surface and Ground Water Quantity. Surface water runoff in Miller Gulch would decrease during the life of the project but would not impact downstream users. It likely would return to near normal levels after reclamation was complete and when surface water on the impoundment could be discharged into the drainages. The decrease in runoff cannot be quantified but would be greatest during spring runoff.

No impacts to streamflows in Rock Creek or the Clark Fork River would occur for any alternative. There would be some reduction in ground water flows down gradient from the impoundment due to the extraction wells for all action alternatives. Once the impoundment seepage and ground water quality under the impoundment returned to premine water quality levels, the extraction wells would be turned off. This would allow ground water flows to return to premine levels.

Wilderness Lakes. ASARCO would leave a minimum of 100 feet of overburden between mine workings and the ground surface. In the vicinity of Copper and Cliff lakes, in excess of 800 feet of overburden exists. Given this thickness of overburden and the inherent strength of the rock, the potential for fracturing and subsidence are extremely remote. Regardless, rock mechanics data from the exploration adit and mined areas would be required for alternatives III and IV. These data would be used for the Agencies' evaluation and approval of updated mine plans prior to mining near the lakes. Impacts to wilderness lakes, wetlands, and associated aquatic life from subsidence would be potentially significant for all action alternatives although the potential for subsidence would be extremely remote.

A contingency plan would be developed to mitigate impacts to the lakes and any associated wetlands to comply with the 404(b)(1) permitting process.

Changes in Wildlife Habitat/Threatened and Endangered Species

Grizzly Bears. The proposed project would physically alter habitat due to the construction of mine facilities (584 acres under Alternative II, 608 under Alternative III, and 542 under Alternative IV). Additional habitat effectiveness would be significantly reduced due to increased human activity. The reduced habitat effectiveness would be greatest during the construction phase. Alternative III impacts the greatest area (3,695 acres) and Alternative IV impacts the least area (2,390 acres).

The increased mortality risk from vehicle-bear collisions, poaching and destruction of nuisance bears could reduce the existing grizzly bear population. Behavior of bears whose territories include the permit area could be modified. Bears could be displaced, feeding patterns could be disrupted, and breeding success interfered with.

The existing Forest Plan standards for grizzly bear management on the KNF have been designed to provide the necessary components for a recovered grizzly bear population across the Cabinet-Yaak ecosystem (a minimum mortality risk, adequate food supply, spatial distribution of habitat and grizzly bears). The existing bear management standards are not being met in Rock Creek and the adjacent area and thus the area is not meeting the requirements for recovery of grizzly bear. The proposed project would result in a further decrease in the grizzly bear standards for Rock Creek and the surrounding area.

The recent bear management approach has been to restrict vehicle use on 6.9 miles of road in the Rock Creek drainage. An additional 4.4 miles (Alternative II) or 4.5 miles (alternatives III and IV) would need to be closed to meet the 0.75 miles of open road per square mile standard for bear analysis areas. These additional road closures, stemming from the proposed project impacts, would not eliminate the impacts nor reduce the significance of the impact on bear recovery. The result is a potential delay in the recovery of the grizzly bear in the Cabinet-Yaak ecosystem due to the proposed project. The significance of the impacts is based not only on the need to minimize effects but on the mandate of the Endangered Species Act to "conserve and recover" the species.

Other Threatened and Endangered Species. The increased risk of road-killed deer would increase the potential for vehicle collisions with feeding bald eagles along Montana Highway 200 and the railroad. Destruction of one of the nesting pairs using the lower Clark Fork Valley would significantly affect recovery of the species in this area. Mitigations for alternatives III and IV include removal of road-killed deer from road rights-of-way. This, in conjunction with the use of FDR No. 150B to access the Miller Gulch rail load-out, would significantly reduce potential impacts to bald eagles.

Migrating peregrine falcons would continue to use the Clark Fork drainage.

Although there are no confirmed sightings of gray wolves within the Rock Creek drainage, suitable habitat would be destroyed and/or rendered ineffective by proposed project activities for all action alternatives. The level of significance cannot be determined at this time.

Big Game Animals. All action alternatives would cause disturbances that could result in some big game (deer, elk, moose, and black bear) being displaced during part of or all of mine life. Some big game habitat, including travel corridors, riparian areas and a few small bull elk wintering areas, would be altered or destroyed due to construction of mine-related facilities. The increase in traffic (1,440 percent increase), particularly along FDR No. 150, would result in more animal-vehicle collisions. Due to increased human knowledge and use of the area there likely would be more hunting and poaching pressure. Alternatives III and IV mitigations would reduce some habitat loss and disturbance, but the overall effects could be similar among all action alternatives. Reclamation plans (see **Appendix G**) for alternatives III and IV would be designed to avoid attracting big game during mine life to help reduce potential problems from big game interfering with reclamation and to avoid creating a mortality risk for the animals; the increased use of native plant species would help achieve the long-term reclamation goal for wildlife habitat restoration.

Neotropical Migrant Birds. The loss of forested and riparian habitats would affect neotropical migrant birds (birds that seasonally migrate from tropical areas such as Mexico to North America). Habitat would be converted primarily to open grass communities, disturbed sites (such as borrow areas and tailings impoundment), or artificial areas (such as roads and buildings). Old growth habitat would be significantly affected (see old growth). Birds associated with old growth habitat could sustain significant impacts. Reclamation plans for alternatives III and IV would create a more diverse vegetative habitat that would better replace lost or disturbed habitat than under Alternative II.

Sensitive Animal Species. All action alternatives could have significant effects on some sensitive species in the short and long terms. The harlequin duck, fisher, lynx, and wolverine would suffer habitat loss and degradation and increased mortality risks that could result in declines in species occurrence and abundance. These could be significant, long-term impacts.

The proposed project and alternatives would create high levels of disturbance (noise, human presence, and some physical land alternation) along Rock Creek that would cause it to become unsuitable habitat for nesting harlequin ducks. As a result, harlequin ducks probably would not successfully breed and/or occur in or near Rock Creek during mine life. Additionally, harlequins potentially may not return to Rock Creek to nest after 35 years (estimated mine life) because the knowledge of Rock Creek as a nesting area could not be passed on to future generations of harlequins. Loss of one of the four breeding areas in the lower Clark Fork drainage and the associated decline in recruitment of the harlequin duck would be significant to the lower Clark Fork subpopulation. Should loss of this lower Clark Fork subpopulation occur, stability of the Montana harlequin duck population could decline.

The proposed project under all action alternatives would alter or make less effective key fisher habitat (old growth, riparian, and travel corridors). While less old growth habitat would be lost under alternatives III and IV, the loss of habitat would be substantial and would result in same effects as Alternative II. Additionally, an increase in mortality risk due to inadvertent trapping, poaching, and vehicle-animal collisions would occur. The proposed project would add to the cumulative habitat degradation, ecosystem fragmentation, and mortality risks that threaten the security and recovery of the fisher in the Cabinet Mountain area.

The proposed project under all action alternatives would have similar, potentially significant effects on the lynx and wolverine as on the fisher. Increased mortality risks from trapping, hunting, poaching, and vehicle-animal collisions would occur. While resulting deaths probably would not be frequent, loss of individuals in these rare species, especially the lynx, could be significant. The proposed project under all alternatives would degrade wolverine and lynx habitat by altering land (such as mill site and road building), creating disturbances (such as mining noise and traffic), and decreasing security of the area, and further fragmenting the narrow Cabinet Mountain ecosystem. Essentially, portions of Rock Creek drainage could become an unsuitable area for lynx and wolverines in the short term. The proposed project would add to the cumulative habitat degradation, ecosystem fragmentation, and mortality risks that threaten the security of the lynx and wolverine in the Cabinet Mountain area.

The proposed project would destroy approximately 580 acres of potential summer and nesting habitat for the Townsend's big eared bat. Winter habitat would not be affected. Impacts to the bat are expected to be minor. Some suitable summer habitat, would be disturbed. There could be the potential to develop winter hibernation habitat within one or more of the adits associated with the proposed project.

Sensitive Aquatic Species. All action alternatives would impact resident populations of bull trout and westslope cutthroat trout in Rock Creek. These impacts would be the result of increased sediment loads from road construction and runoff. Rock Creek already has a high level of fine sediment, close to critical levels, in available spawning gravel. Increased sedimentation would significantly reduce fry emergence and potentially would lead to elimination of these fish populations due to spawning failure. Since Rock Creek and Bull River are the two major spawning areas for the Cabinet Gorge bull trout populations, degradation of the Rock Creek bull trout spawning habitat would significantly impact Cabinet Gorge bull trout.

Alternatives II and III would impact spawning habitat and resident fish populations the entire length of Rock Creek from the upper mill site to the Clark Fork River. These two action alternatives could have the greatest potential impact to the Cabinet Gorge bull trout populations. However, under alternatives III and IV, the identification and reduction of 130 acres of existing sediment sources in the Rock Creek and the Bull River drainages by ASARCO prior to mine construction would help offset short-term increases in sediment due to facility construction. The possible reduction of sediment sources in spawning streams in the Bull River drainage could improve bull trout populations and viability in those streams. These mitigations could reduce project-related impacts to the Cabinet Gorge Reservoir bull trout population. Other mitigations, such as construction-BMP monitoring also would help reduce sediment impacts to sensitive aquatic species under alternatives III and IV.

Moving the mill site to the Rock Creek confluence (Alternative IV) eliminates project-related impacts to populations of bull and westslope cutthroat trout in the West Fork of Rock Creek as well as reducing sediment impacts to spawning habitat and fish populations in Rock Creek below the confluence with its East Fork. Impacts to the Cabinet Gorge bull trout populations would be further reduced.

Plant Species of Special Concern. All action alternatives would disturb or eliminate several populations of sensitive plant species, including crested shield-fern, a KNF-designated species. A conservation assessment will be conducted to determine the significance of the loss of populations of this species. Field verification of population locations would be conducted during field road alignment (to finalize road layout and design) for alternatives II, III, and IV. Minor road alignment changes could result in avoiding some sensitive plant species populations although the impoundment would eliminate seven populations for all action alternatives. None of these would be crested shield-fern.

Mountain Goats. All action alternatives could result in a decline in health and numbers of the Rock Peak goat herd by increasing levels of disturbance, stress, mortality threats and degradation of habitat. Disturbances (such as noise, smells, and perceived or actual human presence) would result in goats being stressed and some habitat becoming undesirable and/or less effective. Goats suffering higher stress levels could lead to declining health, vigor, and reproductive potential of individuals and/or the Rock Peak goat herd. Additionally, these disturbances could displace some goats from their habitat. Displaced goats also would suffer higher stress levels.

Mine-related disturbances would affect up to 8,492 acres of goat habitat at various times during project life (not all the 8,492 acres would be affected at the same time). Noise mitigations proposed under alternatives III and IV would substantially reduce noise and related impacts around the wilderness ventilation adit (450 acres) which is located in important habitat.

Increased access and human use of the area also would increase disturbances and mortality threats to goats. Goat mortality due to poaching and hunting would likely increase as a result. Road closures for grizzly bear mitigation would reduce impacts due to human use and associated disturbances.

Impacts on the Rock Peak herd would be compounded when impacts from Noranda also are considered. The shifting of animals out of the Rock Creek and Ramsey Creek drainages into the CMW from either side could increase the stress of the displaced animals. It also could increase the use of unaffected summer ranges creating potential conflicts with resident goats in the CMW.

Pileated woodpecker. All action alternatives would have a potentially significant effect on local populations of the pileated woodpecker. This impact would be caused by eliminating or degrading key habitat (primarily old growth) ranging from 21 to 9.3 percent loss (alternatives II to IV, respectively). The anticipated small stand size, lower habitat quality, and limited quantity of habitat would affect sustainability of local populations .

Impoundment Stability

Tailings would be disposed in an impoundment located just west of the lower reach of Rock Creek. Conceptual impoundment designs were developed assuming a 7.0 earthquake along the Bull Lake Fault 16 miles away. Under Alternative II, ASARCO proposed constructing the impoundment using the upstream method. The modified design for alternatives III and IV specifies the centerline method for 7 years and the upstream method for the remainder of mine operation. The modified design also would include compacting the tailings beach, possible removal of soft clays under the starter dams, and constructing a concrete shear wall under one of the starter dams to reduce the risk of impoundment failure. Although both designs would be subject to review and approval by the Agencies, the modified design for Alternative III also would be subject to a technical panel review including a review of a feasibility study on the use of alternative methods to reduce seepage. Failure of the impoundment, while a remote possibility, would have a significant impact to surface waters and aquatics/fisheries.

Changes in Socioeconomics

Employment. The development of this project would result in a boom-bust employment cycle with a peak employment of 433 construction and 355 mine operation workers for alternatives II and III. The additional construction time required for Alternative IV (3 years compared to 1.5 for alternatives II and III) would reduce the peak construction work force to 350 workers but impacts would still be moderate to major. About 140 to 150 indirect jobs would be generated for alternatives II through IV. Approximately 50 percent of the construction workers and 80 percent of the mine operation workers would be hired locally.

Population. Sanders County would experience a population increase of approximately 4 percent and Bonner and Lincoln counties would increase by less than 0.4 percent during mine construction (a total of 483 people). This would drop to less than 3 percent for Sanders County and 0.15 percent for Bonner and Lincoln counties during mine operation (a total of 227 people). Alternative IV would reduce the peak construction-related population influx to 380 people. This could result in significant impacts on Sanders County and city services (see Community Services). Since population increases associated with the Montanore Mine are primarily in Lincoln County, there would not be a significant cumulative impact to Lincoln County.

Income. All action alternatives would generate approximately $9.6 million dollars of annual personal income and indirectly stimulate an additional annual income of $1.5 million in the three-county area. This would have a minor (2 percent) impact on the area's personal income.

Housing. Housing, especially rental units, is already limited in the project vicinity. Demand for rentals during mine construction would be expected to create a housing shortage. A moderate-sized mobile home court or an apartment building would need to be developed to meet these needs. New home construction probably would increase once the mine began operating and long-term residences would be needed for mine workers. Increased housing costs may impact people on fixed or low incomes. After mining operations ceased, there might be a surplus of houses in the area.

Community Services. ASARCO's Hard Rock Impact Plan has not been developed to identify how financial mitigations for impacts to local government services would be implemented. It would be likely that the plan would provide relief needed to mitigate the impacts identified below for any action alternative.

The increase of students (total of 63 elementary and 29 high school) during mine construction may exceed classroom capacities and school accreditation standards in Sanders County (41 elementary and 19 high school). Since this temporary increase would end after approximately 1.5 to 2 years, local schools may decide to maintain current educational quality by hiring additional teachers rather than increasing class sizes. A total of only 63 new students (44 in Sanders County) would be enrolled during mine operation.

Rapid immigration and increased mine traffic could result in the need for additional law enforcement, including Montana Highway Patrol personnel, and fire protection personnel.

Community water facilities in Noxon and Heron are near capacity. Impacts to ground water resources for private wells cannot be determined at this time. Thompson Falls sewage treatment facility is near capacity and would not be able to accommodate additional demands.

Fiscal. This project would generate direct increases in property tax revenue to local governments; this would peak at about $600,000 for Sanders County during the second year of production. Additional revenues would be generated by the Gross Proceeds Tax, the Metals Mines License Tax (estimated to be a maximum of $300,000 in Sanders County), and the Resource Indemnity Trust Tax. Increases in personal property and income taxes would occur as a result of increased employment, personal property taxes, and purchase of local services and merchandise. ASARCO's Hard Rock Impact Plan would allocate these tax revenues to more closely match the timing and scope of increased local demands for government services (see above). This plan would be negotiated between ASARCO and the local governments (see Chapter 1).

Land Use. All action alternatives would restrict the potential land uses (especially residential, commercial, and industrial uses) of about 400 acres at the impoundment site. Minor land use changes would be associated with new mine-related housing and commercial development. The acquisition of land or placement of conservation easements for grizzly bear mitigation would restrict future residential and commercial development on about 3,000 acres for alternatives II and III and about 2,300 acres for Alternative IV.

Changes in Old Growth Ecosystems

Old Growth Habitat. All action alternatives would physically destroy and/or disturb old growth, rendering it biologically less effective or ineffective. Alternative II would affect a total of 208 acres; Alternative III, 154 acres; and Alternative IV, 91 acres. Mining-related disturbances would fragment stands below the 50-acre limit and create more edge affect in larger stands. The percent of biologically effective habitat would be below the 8 to 10 percent needed to support old-growth-dependent species for all action alternatives (a range of 5.5 for Alternative II to 6.4 percent for Alternative IV). Pileated woodpeckers, goshawks, and fishers are among old-growth-dependent species that would be affected by this loss. In turn, there could be a potentially significant decline in species diversity under all action alternatives.

Changes in Waters of the U.S. and Wetlands

All three action alternatives would fill Waters of the U.S. and wetlands (see **Table 2-4**). The tailings impoundment would directly and indirectly impact the same 5.4 acres of wetlands for all action alternatives. The location of the mill site and waste rock dump and the alignment of FDR No. 150 determines the total amount of wetlands and Waters of the U.S. impacted by each alternative. Alternative II would impact a total of 8.1 acres of wetlands and 1.5 acres of Waters of the U.S. Alternative III would impact a total of 6.2 acres of wetland and 1.5 acres of Waters of the U.S.; and Alternative IV would impact a total of 6.0 acres of wetland and 0.4 acres of Waters of the U.S. These would be significant impacts.

Temporary indirect impacts to Waters of the U.S. and wetlands would occur during construction of roads and the mill pad due to increased sediment contributions. Proposed BMPs would reduce sediment contributions. Alternatives II and III would have temporary impacts along the entire length of Rock Creek and both forks. Alternative IV primarily would have indirect impacts below the confluence of the East Fork of Rock Creek. Very few indirect impacts would be associated with the exploration adit other than the reconstruction of FDR No. 2741.

ASARCO has identified 12.3 acres of wetland mitigation sites and 1.5 acres of Waters of the U.S. mitigation sites for Alternative II (see **Table 2-5**). Only 10.5 acres of the wetland mitigation sites would be available for alternatives III and IV due to the realignment of a segment of FDR No. 150. There are, however, potential sites within the riparian zone (a composite of wetland and upland vegetation sites) along Rock Creek that could be identified and used for mitigation should the COE require additional mitigation areas. The mitigation sites would be developed as replacement wetlands prior to disturbance of the existing wetlands. The 1.1 acres of Waters of the U.S. at the upper mill site (alternatives II and III) would not be reconstructed until the mill site was reclaimed. The 0.4 acres of Waters of the U.S. along the FDR No. 150 and the utility corridor under all action alternatives would be temporarily impacted during construction. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek, and attenuate peak flows. A temporary but potentially significant decrease in some of the wetland functions and values could occur until the created wetlands were revegetated and fully established.

Changes in Transportation

Public Access. All action alternatives propose both new road construction and road reconstruction. These activities would create traffic delays and temporary road closures. A traffic management plan would allow private landowners reasonable access to their property and public access to NFS lands.

Alternatives II and III would include a bypass around the West Fork mill site to allow access to FDR nos. 150 and 2741 above the mill. However, public access through either mill site or on the mine portal access road (alternatives II and IV) would be restricted. Alternatives III and IV would also restrict public traffic on FDR No. 150B around the impoundment.

The paving and widening of FDR No. 150 and upgrading of FDR No. 2741 would improve access to the CMW and for general recreational activities in the drainage. Indirect impacts to some wildlife species would be created by increased accessibility for hunting, trapping and poaching (see Big Game Animals, Sensitive Animal Species, and Mountain Goats). FDR No. 150 above the confluence mill site would not be paved for Alternative IV although minor improvements to FDR nos. 150 and 2741 would occur for access to the exploration adit; therefore, public access on those roads would remain similar to Alternative I.

Traffic Safety. The proposed project would generate increased traffic on FDR No. 2741 during exploration and on Montana Highway 200 and FDR No. 150 during mine construction and operation for all action alternatives. Alternatives II and III also would increase traffic on the lower portion of FDR No. 2741 during mine operation. Routing ore concentrate haulers along Montana Highway 200 to the Hereford rail load-out would create the potential for increased traffic accidents. Ore trucks would be travelling at slower speeds than general traffic and would be turning across the highway going to and from the load-out. Alternatives III and IV route the ore trucks along reconstructed FDR No. 150B at the base of the impoundment to the Government Mountain Road and the Miller Gulch rail load-out. This would eliminate conflicts between ore trucks and general traffic on the highway. Restricting public use of FDR No. 150B also would avoid conflicts on that portion of the haul route. Relocation of the rail load-out to Miller Gulch eliminates potential confrontations, including accidents, with residential traffic at Hereford.

Alternative II's proposed road alignment for the intersection of FDR No. 150 and Montana Highway 200 does not meet highway standards for sight distance, increasing the potential for accidents with turning traffic. Alternatives III and IV would relocate the road intersection to comply with the standards.

Changes in Aesthetic Quality

Noise. All action alternatives could create significant long-term noise-related impacts to mountain goats and their critical summer habitat (see above). These impacts would be associated predominantly with the exploration adit and the wilderness ventilation adit. Sound mitigations at the ventilation adit would minimally reduce the impacts. Alternative IV may also affect critical winter range at Rock Creek Meadows should loud noises, such as blasting, reach the winter range.

Blasting during adit construction would generate noise up to 80 dBA in the CMW and the Clark Fork Valley. While general mine operations would not be audible in the Clark Fork Valley, the operation of heavy equipment at the impoundment site would be audible in adjacent areas. Activities at the Hereford rail load-out (Alternative II) would significantly increase noise levels to residences in the area. Relocation of the load-out to Miller Gulch would eliminate that impact and place the noise in a less populated area.

Recreationists using the Rock Creek drainage and FDR nos. 150 and 2741 would be able to hear mine and mill operations when within a mile of the facilities. Traffic related noise on FDR No. 150 would be increased significantly from 30 to 70 dBA. The level of the noise would be somewhat reduced in alternatives III and IV with the implementation of several noise mitigations.

Noise impacts to recreationists within the CMW would be associated primarily with the exploration and wilderness ventilation adits and blasting and construction equipment noises (up to 80 dBA). Impacts from exploration activities would be greatest during the first couple of years of mine activities; after that, noise would only be generated by ventilation exhaust fans. Sound from all adits would be audible (at 45 dBA) for approximately 1 mile away from the sites. The wilderness ventilation adit would only be in place and used during the last 15 to 20 years of mining. These sounds would negatively impact CMW visitors using nearby areas. Sound mitigations in alternatives III and IV would reduce the fan noise to background levels (30 dBA) within 100 feet.

Scenic Quality. Proposed timber sale activities will have an impact on the existing visual quality. All three action alternatives would result in significant visual impacts for the Rock Creek drainage and Clark Fork Valley. Impacts would be associated with all features of the proposed project: the exploration adit, the mill site, the mine portal and associated waste rock dumps, the ventilation adit (see wilderness below), the utility corridors and the impoundment.

The exploration adit portal would be most noticeable from Government Mountain, though the impacts would diminish with distance. Lights from night operations would be visible in portions of the Clark Fork Valley. These visual impacts would be reduced in alternatives III and IV. The waste rock dump would be revegetated to reduce contrast. Lights would be screened or baffled to reduce visibility across the valley.

The upper mill site in alternatives II and III would be highly visible to the public using FDR nos. 150 and 2741 but not visible from the Clark Fork Valley. The conveyor from the mine portal would create a strong linear feature that would contrast greatly with the natural landscape. The cut-and-fill slopes of the new mine access road for Alternative II would be visible for a long time. Under Alternative III, the new mine access road would not be built, reducing the amount of disturbance and visibility. The buildings would be painted or treated to reduce the amount of contrast.

The waste rock dump for Alternative II would be a prominent feature that would be difficult to revegetate and would remain highly visible for many years. The dump would be divided into two smaller dumps in Alternative III and graded closer to the natural slopes than was proposed in Alternative II. The dumps would be topsoiled and revegetated to facilitate reduction of visual impacts.

Alternative IV would move the mill site to the confluence with the East Fork of Rock Creek. A minimum 100-foot visual buffer would be left on either side of FDR No. 150 to provide screening. There would be no waste rock dump for this alternative as the rock would be used to build the mill pad and the impoundment starter dams. The face of the mill pad would be reclaimed immediately after construction. Visual impacts from the confluence mill site would be potentially significant.

Either design of the impoundment would result in a large artificial form visible from several areas in the Clark Fork Valley. The size, form, color and texture of the impoundment would contrast dramatically with the surrounding landscape. The long-lasting effects would gradually be reduced as trees and shrubs were established. Reclamation of the impoundment face would be done concurrently throughout mine life for Alternative II. Trees and shrubs, however, would be planted after the face of the impoundment was completely reclaimed for Alternative II. Alternatives III and IV would require additional detailed regrading and revegetation plans to facilitate the mitigation of visual impacts. Reclamation, including the planting of trees and shrubs for alternatives III and IV, would begin after year 7 and would be concurrent until operations ceased. Trees would also be planted along Montana Highway 200 for screening as soon as Agency permits were approved.

The proposed Visual Management System (VMS) Visual Quality Objectives (VQO) would not achieved during mine life for all action alternatives. The impoundment surface potentially could never meet Retention VQO standards under Alternative II, but additional reclamation requirements under alternatives III and IV would increase the likelihood that the standard could be achieved within several decades after final reclamation. Under Alternative IV, the elimination of the waste rock dump, immediate planting of the mill pad face, and the visual buffer around the confluence mill site would further help this site meet VQO standards. Although the facility sites could eventually achieve prescribed VQOs several decades after mine closure and final reclamation, the additional reclamation requirements would shorten the amount of time required, but it would still take decades.

Wilderness. There would be two types of impacts to users of the CMW: noise-related and visual. The noise-related impacts would be greatest during the construction and operation of the exploration adit, construction of the mine adits and mine pad and the construction and operation of the wilderness ventilation adit (see Noise). Mitigations under alternatives III and IV would reduce these potentially significant impacts. Visual contrast of the impoundment surface would remain for all action alternatives due to its light color until completion of mine revegetation following mine closure. The area of disturbance for the ventilation adit would be reduced in alternatives III and IV by its relocation to a steeper site. Either location, however, is not in proximity to high use areas such as Rock, Saint Paul, and Moran lakes. Reclamation mitigations proposed under alternatives III and IV would restore a premining appearance to the ventilation adit.

PART VI: THE AGENCIES' PREFERRED ALTERNATIVE

The Agencies' preferred alternative is Alternative IV, Modified Project with Mitigations. Alternative IV would result in construction of the exploration adit, mine, mill, tailings impoundment, rail load-out, passive biotreatment facility, and access roads. Some water would be stored in underground workings and/or the tailings impoundment, but excess water would be discharged to the Clark Fork River after treatment. Environmental requirements in addition to those proposed by ASARCO would be incorporated to minimize (to the extent possible) or eliminate environmental impacts. Additional monitoring would help detect trends as well as unacceptable impacts, should they occur. Measures would be developed to respond to and control these impacts.

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CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

Chapter 3 presents descriptions of the existing (baseline) environment. The environmental components, or resources in the project area that would either be affected by the proposed action alternatives or would affect the action alternatives are described in the following sections. These include physical, biological, social, and economic resources. The resources related to significant issues identified in Chapter 2 are described in the most detail. Other resources are discussed briefly. Additional details are provided in the permit application baseline study reports and other resource-oriented documents referenced throughout this chapter.

Geographical Study Areas

The geographical limits for the analysis of probable impacts in this EIS primarily encompass the permit area and exploration adit, including the mine, mill site, and transportation and utility corridors, tailings impoundment and rail load-out. Where geographical limits were established beyond the permit area to allow required analyses and assessment of impacts, a description follows:

> ***Hydrology.*** *The study area for hydrology includes the Rock Creek and Miller Gulch watersheds and the Clark Fork River below Noxon reservoir in Montana. For purposes of this EIS, it is assumed that potential impacts to Cabinet Gorge Reservoir (Clark Fork River below Noxon Dam) are representative of potential impacts to Lake Pend Oreille.*
>
> ***Aquatics/Fisheries.*** *The study area for aquatics/fisheries includes Rock Creek watershed and Clark Fork River from Noxon Dam down to and including Lake Pend Oreille.*
>
> ***Wildlife Habitat.*** *The wildlife habitat study area includes the wildlife study area as described below, and the old growth study area (timber stand compartment 711) in the Rock Creek drainage.*
>
> ***Wildlife.*** *The original wildlife baseline study, conducted in 1985 (Farmer and Heath, In ASARCO, Incorporated 1987-1994), encompassed an intensive study area of 10 square miles and an extended study area of 125 square miles. The proposed permit area lies within the intensive study area. Analysis area size varies for each species because homeranges and effects differ in size and manner. Therefore, for some species, analysis area was greater or different than the original baseline study area.*
>
> ***Socioeconomic.*** *The primary socioeconomic impact area for the proposed project is western Sanders County, along Montana Highway 200. Affected towns would include Noxon, Heron, and Thompson Falls. Affected school districts would include Noxon/Heron, White Pine, and Thompson Falls. Some additional baseline information is presented for Lincoln and Bonner counties since these counties may receive slight socioeconomic spillover effects, particularly during project construction.*

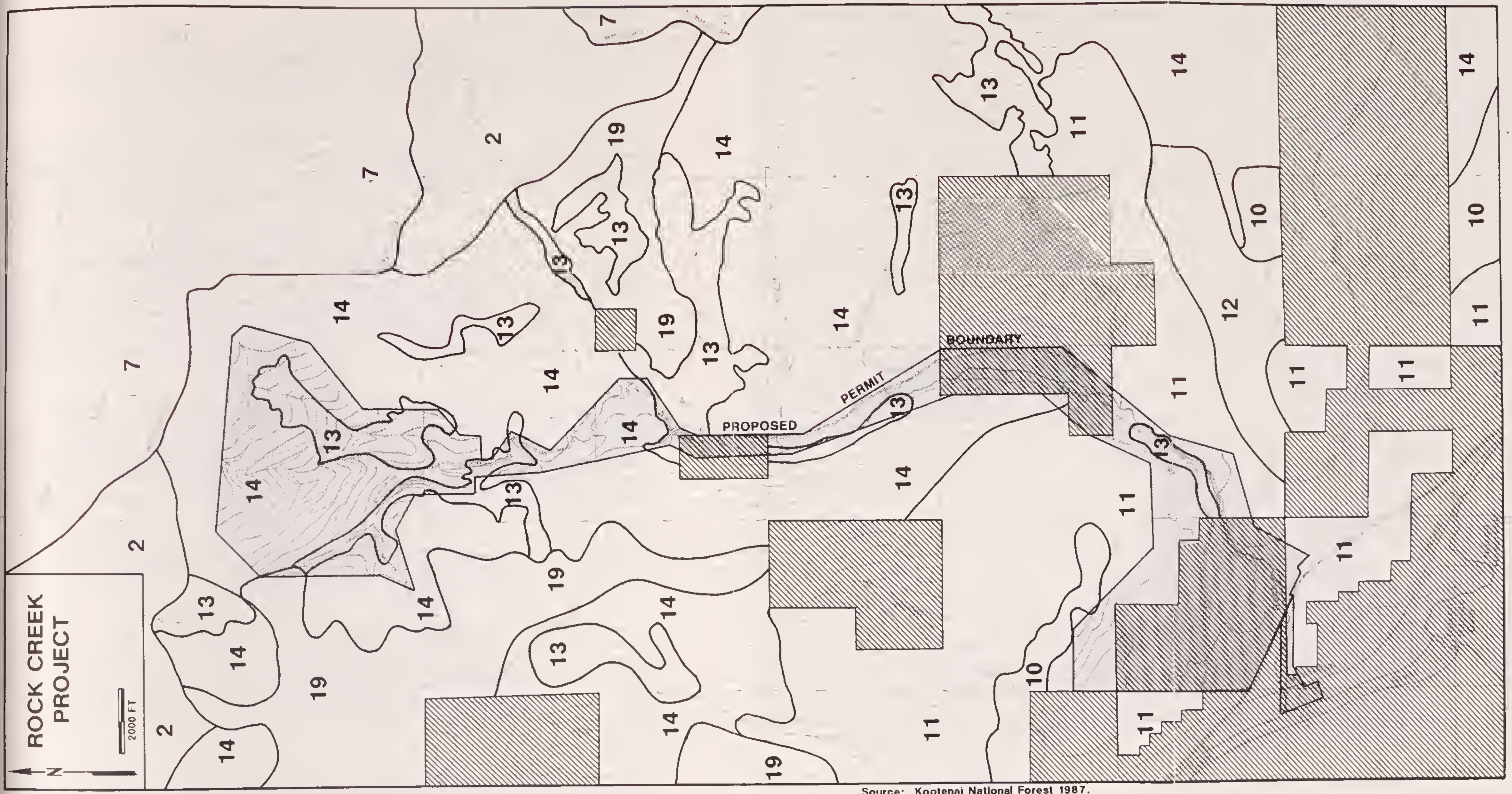
> ***Transportation.*** *The transportation study area includes the north and northeast portions of Sanders County, and the middle and midwest portions of Lincoln County, Montana. It includes U.S. Highway 2 from Libby to Montana Highway 56, Montana Highway 56 from U.S. Highway 2 to Montana Highway 200, and Montana Highway 200 from Plains to Montana Highway 56.*
>
> ***Recreation.*** *The recreation study area includes Sanders County and that portion of Lincoln County covered by the Cabinet Mountains Wilderness (CMW).*
>
> ***Wilderness.*** *The wilderness study area includes the CMW and areas proposed in the Kootenai Forest Plan for addition to the CMW.*
>
> ***Sound.*** *The study area for sound includes all areas that could experience increased noise levels from the proposed project, specifically: the project permit area, the CMW, project-affected traffic corridors, and proposed and alternative rail sidings.*
>
> ***Scenic Resources.*** *The scenic resource study area includes public and private land bounded by the Cabinet Ranger District (RD). This area generally extends south from Bull Lake and the southwest flank of the Cabinet Mountains to Trout Creek, through the Clark Fork Valley to the Montana-Idaho state line. The Three Rivers, Fisher River, and Libby RDs and Lolo National Forest border the study area to the north, east, and south.*

KOOTENAI FOREST PLAN

The Kootenai Forest Plan (1987) directs all local National Forest land management, and restricts or prohibits unauthorized land uses. All lands are managed for specific purposes according to the Management Area (MA) direction. Management prescriptions are specified for each MA by resource, including wildlife habitat, timber, wilderness, recreation, visuals, water resources, grizzly bear habitat, transportation, or developed facilities.

Forest Plan goals provide the general long-range intent that directs overall forest operations. The goal for minerals is to "encourage responsible mineral development of mineral resources in a manner that recognizes national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation." The goals for wildlife include providing sufficient habitat for the recovery of threatened and endangered species, maintaining 10 percent of each major drainage in old growth species habitat, and maintaining big game and fisheries species habitat. The objectives for transmission line corridors are to use MA requirements to set transmission line exclusion, avoidance, and window areas when siting transmission corridors. Transmission line corridor criteria are outlined in Appendix 15 of the Kootenai Forest Plan (1987). The Forest Plan goals or objectives for threatened and endangered species, recreation, wilderness and scenic resources are described in more detail under those sections in this chapter.

The Forest Plan sets the goals and standards for 23 MAs located on the forest. **Figure 3-1** shows the location and distribution of MAs within the project area.



Source: Kootenai National Forest 1987.

#2 - Semi-primitive Non-Motorized Recreation (unsuitable timberland)
#7 - Existing Wilderness (Cabinet Mountains Wilderness)
#10 - Big Game Winter Range (unsuitabla timberland)
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#12 - Big Game Summer Range (suitable timberland)
#13 - Designated Old Growth Timber (unsuitabla timberland)
#14 - Grizzly Habitat Management (suitable timberland)
#19 - Steep Lands (unsuitable timberland)

FIGURE 3-1
Location and Distribution of KNF Management Areas
Rock Creek Project

KNF is continuing to update MA boundaries as better information becomes available. Brief descriptions of these MAs are given in the following section. Except for MA 7, all MAs use Forest-wide goals and objectives for mineral development.

MA 2 Semiprimitive Nonmotorized Recreation. The goal of this MA is to protect and enhance roadless recreation areas and to provide for wildlife, particularly the grizzly bear, where wildlife values are high. Roads are not allowed for surface activities. Single-use roads may be justified for mineral exploration. Some areas are occasionally opened to seasonal snowmobile use. Trails are closed to all motorized vehicles. This MA is a corridor avoidance area for transmission lines.

MA 7 Existing Wilderness. This MA is composed entirely of the CMW and managed in accordance with the Wilderness Act of 1964. Area goals include maintaining natural ecosystems, providing opportunities for solitude and primitive recreation, and providing critical grizzly bear habitat. Wildlife habitat may be provided, but not by human manipulation. Existing mineral rights are recognized and these rights are managed in accordance with the Wilderness Act and other laws. Road construction to mineral deposits can be permitted when valid existing rights have been established, and when roads are found to be necessary for mineral development. This MA is a transmission line corridor exclusion area.

MAs 10 Big Game Winter Range (unsuitable timber) and MA 11 Big Game Winter Range (suitable timber). The goal for these MAs is to maintain and enhance winter range habitat effectiveness for big game wildlife species and to maintain the viewshed in areas of high viewing significance. The standards concentrate on protection of important wintering areas and providing optimum habitat for elk, mule deer, white-tailed deer, moose, sheep, and goats for winter survival. These areas are transmission line corridor avoidance areas in grizzly habitat. Programmed timber harvest is not allowed in MA 10, but is authorized in MA 11.

MA 12 Big Game Nonwinter Range (suitable timber). The goal of this MA is to maintain or enhance nonwinter big game habitat and produce a programmed yield of timber. The MA is characterized by suitable timber-producing sites and moderate to rolling topography.

MA 13 Designated Old Growth Habitat. This MA provides the special habitat necessary for old growth-dependent wildlife, on a minimum of 10 percent of each drainage, in habitat units that provide a diversity of suitable types. Old growth forests are specific successional forests that have large multilayer forest canopies, an average age of more than 200 years and sufficient area to provide for the habitat requirement of old growth wildlife species. Surface-disturbing activities are allowed only where they would not reduce stand sizes below habitat effectiveness thresholds. This is an avoidance area for transmission lines.

MA 14 Grizzly Bear Habitat Management. This area is designed to enhance or maintain critical habitat for the recovery of grizzly bear populations, to reduce human/bear conflicts, to provide a programmed level of timber, and to maintain or enhance big game habitat. Key grizzly habitat components, such as wet meadows, bogs, and security areas will be maintained or enhanced. This MA is classified as a transmission line corridor avoidance area.

MA 19 Steep Lands. The purpose of this MA is to protect and maintain the vegetative cover of steep lands where soil stability and water quality can easily be disturbed by surface disturbance. The goal is maintain the vegetation in a healthy condition to protect the lands from soil movement and water erosion. This area is generally not suitable for road building or timber cutting. This area is a transmission line corridor avoidance area.

Riparian Areas. Goals for these unmapped areas are intended to apply to all riparian areas within other MAs by protecting riparian vegetation to minimize soil and water erosion, ensure habitat for fish and wildlife (including the grizzly bear), and provide a pleasant view. Vegetative standards concentrate on minimizing simultaneous forest openings on both sides of a stream, following wildlife habitat guidelines, and restricting the use of site-disturbing equipment.

CLIMATE

The climate of the project area can be described as a combination of modified Pacific maritime and continental climates. The maritime influences are strongest in the winter when relatively warm, moist air from the Pacific Ocean is cooled as it is lifted over the mountains and mixes with colder Arctic air moving south. This results in snowfall with significant accumulations in the higher elevations. Continental influences are more prevalent in the summer with thundershowers during May and June followed by hot, dry weather into mid-September.

Annual precipitation totals vary from about 30 inches along the Clark Fork River Valley to about 80 inches at the highest elevations in the CMW. The nearest weather station, located at the Trout Creek Ranger Station, has recorded a long-term average precipitation of 30.49 inches per year. January has the highest monthly average at 4.95 inches and July has the lowest at 0.96 inches (National Oceanic and Atmospheric Administration 1987). Annual estimated precipitation (34.49 inches) exceeds estimated evaporation (31.50 inches) by about 3 inches in the proposed tailings impoundment area (ASARCO, Incorporated 1987-1994).

Temperatures in the area are moderate. During the summer months, minimum (night-time) temperatures are in the 50 to 60 degree Fahrenheit (°F) range. Winter cold waves occur, but mild weather is more common. The long-term annual average temperature at the Trout Creek Ranger Station is 44.8°F. The warmest month, July, averages 65°F and the coldest month, January, averages 24°F (National Oceanic and Atmospheric Administration 1987).

Wind speed and wind direction were monitored at the proposed tailings area for over a year as part of ASARCO's baseline monitoring program. The predominant wind directions parallel the Clark Fork River Valley. Wind speeds were generally light, with an average speed of 4 miles per hour (MPH) and a maximum 1-hour wind speed of 17 MPH. The frequency of wind from the west-northwest through north-northwest (up-valley winds) was 30.2 percent, while frequency from the east-southeast through south-southeast (down-valley winds) was 30.1 percent (TRC Environmental Consultants, Inc. *In* ASARCO, Incorporated 1987-1994). Wind measurements were not made at the proposed plant site.

Similar wind flow patterns following the West Fork Rock Creek drainage would be expected; however, there would be some variation due to the complexity of the terrain.

The project area, similar to other valleys in western Montana, has a strong potential for the formation of temperature inversions (stable atmospheric conditions with little air mixing). Results of the baseline monitoring program indicated a frequency occurrence of stable conditions at about 40 percent of the year.

AIR QUALITY

The air quality study area includes the proposed plant site and the tailings impoundment area for purposes of the baseline monitoring program. Ambient air quality monitoring for particulates or gaseous pollutants has not been done in the CMW; however, air pollutant levels in the wilderness are assumed to be very near naturally occurring background levels due to minimal human impact.

Current air quality at the proposed project site is very good based on the particulate baseline monitoring that has been done. **Table 3-1** presents a summary of existing pollutant concentrations observed during the baseline monitoring program. These levels should also be representative of the more rural areas of northwest Montana.

Dust collected on the sample filters from the monitoring program was also analyzed for trace element concentrations, including arsenic, antimony, cadmium, chromium, zinc, copper, and iron. These trace element concentrations were all well below the allowable guideline values used by the Montana Air Quality Division. Monitoring of gaseous pollutants was not done due to the lack of significant sources in the immediate area. Levels are assumed to be low and typical of background conditions in the region.

Current air pollutant (gaseous and particulate) sources in the proposed plant site area include logging activities and vehicle traffic. Pollutant emissions in the Clark Fork Valley are more extensive given the higher traffic levels and home heating/wood burning. Regional impacts from forest fires, slash burning, and agricultural burning to the west occasionally occur.

The proposed project area is designated as Class II under the Prevention of Significant Deterioration (PSD) regulations[1], and the nearby CMW is Class I.

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[1] The PSD program was originally enacted by Congress in 1977; the authority to implement the provisions was subsequently delegated to the State of Montana. The goals of the program are as follows: a) To protect public health and welfare, including the prevention of significant deterioration of air quality in areas where ambient standards are currently being achieved; b) to emphasize the protection of air quality in national parks, wilderness areas, and similar areas of special concern; and c) to ensure that economic growth in clean areas occurs only after careful deliberation by state agencies and local communities.

The program is implemented primarily through the use of pollutant increments and area classifications. An increment is the maximum increase (above a baseline concentration) in the ambient concentration of a pollutant that would be allowed in an area. Increment systems have been in place for particulate matter and sulfur dioxide for a number of years and in 1988 were adopted for nitrogen oxides. The area classification scheme establishes three classes of geographic areas and applies more stringent increments to those areas recognized as having higher air quality values. Class I areas are accorded the highest level of protection by allowing the smallest incremental pollutant increase.

TABLE 3-1.
Baseline Air Monitoring Summary

POLLUTANT	SITE	TIME INTERVAL	CONCENTRATION (ug/m^3)[1]	BASIS
TSP[2]	Highway 200[3]	Annual Average	16.5	Arithmetic[7] Mean
		Annual Average	11.5	Geometric[8] Mean
		24-Hour Maximum	56.9	
TSP	Mill[4]	Annual Average[5]	23.2	Arithmetic Mean
		Annual Average[5]	19.0	Geometric Mean
		24-Hour Maximum	69.9	
PM10[6]	Highway 200	Annual Average	10.4	Arithmetic Mean
		Annual Average	6.6	Geometric Mean
		24-Hour Maximum	41.2	
Lead	Highway 200	90-Day Average	0.08	
Lead	Mill	90-Day Average	0.13	

Source: TRC Environmental Consultants, Inc. *In* ASARCO, Incorporated 1987-1994.

Note:
[1] ug/m^3 - micrograms per cubic meter of air sampled.
[2] TSP - total suspended particulate - measured with high volume sampler.
[3] proposed tailings impoundment
[4] proposed mill site
[5] annual averages for the mill site are based on partial year data.
[6] PM-10 - Particulate matter with a diameter of 10 microns or less.
[7] The average of the concentration values for this time period.
[8] A number midway between the first and the last.

GEOLOGY

Physiography

The Cabinet Mountains are bounded on the south by the Clark Fork River, on the east by Libby Creek, and on the north by the Kootenai River. The Bull River and Lake Creek valleys separate the mountain range into east and west segments. The project area is in the southeast portion of the Cabinets, just north of the Clark Fork River.

The Cabinets are a northwest-trending mountain range of rugged relief. Maximum relief in the project area is about 5,500 feet. The highest elevation is Saint Paul Peak at elevation 7,714 feet. The lowest elevation is below the proposed tailings impoundment site along the Clark Fork River which, near its confluence with Rock Creek, has an elevation of about 2,200 feet.

The area's topography is a function of the underlying rock types, structure (faults and folds), and geologic history. Rocks in the area are relatively strong and not easily erodible. Most of them weather into small, platey fragments that form a colluvial (transported by gravity) mantle overlying bedrock. Quartzite in the Revett Formation -- due to its hardness and fracturing -- tends to weather into blocks, forming extensive talus slopes in places.

Large faults bound the Cabinet Mountains on the east, south, and west. These faults are at least partly responsible for the formation of the valleys surrounding the Cabinets. The Clark Fork River, Libby Creek, Bull River-Lake Creek, and the West Fork Rock Creek valleys are all located along faults. A number of smaller streams in the study area also may be located along fault and fracture structures.

Topography in the project area has been greatly influenced by Pleistocene-age glaciation. In the ore body area, Pleistocene alpine glaciers carved the landscape into a series of aretes, cirques, and horns characterized by nearly vertical cliffs, ledges, steep colluvial slopes, and talus fields. The high peaks of the area (Saint Paul, Rock, and Elephant peaks) are glacial horns, formed by the headward erosion of the glaciers. Small-to-moderate-sized lakes (tarns), such as Copper and Cliff lakes, have formed in the glacial cirque basins.

Melt-waters from glaciers in the upper part of the project area carried large amounts of excavated rock debris into Rock Creek, thus filling portions of the valley bottom. Relic terraces of the former valley bottom are exposed as higher level benches along lower Rock Creek. In many areas the creek has since down-cut into the valley fill.

Rock Creek flows through a fairly narrow canyon and then spills into the wider Clark Fork Valley. The northwest-trending Clark Fork Valley is 2 to 3 miles wide at this point. It has a relatively flat to rolling bottom, with lakebed and stream deposits capping and surrounding shallow to exposed bedrock.

Mining History

Mineral activity in this area dates back to the 1860s with the discovery of placer gold along Libby Creek on the east side of the Cabinet Mountains (Johns 1970). Subsequent exploration in the 1880s and 1890s led to the discovery of numerous small lode deposits. Many of these lodes were discovered along the east face of the Cabinets. Production from these veined lodes and the area's placer deposits was sporadic and short-lived. None are currently in production.

In the late 1890s and then in the 1920s and '30s, several small prospects were worked west of the Cabinet divide in and around the project area. The Freeman prospect occurs just above Copper Lake, within the area ASARCO proposes to mine. It consists of a few short adits and workings in a northwest-striking copper/silver quartz vein in the Copper Lake Fault Zone. The Heidelberg Mine, located about 2.5 miles to the east, consists of several adits and at least one shaft just south of Rock Lake. Most of these old workings were driven on gold-bearing quartz veins in what is probably the southern end of the Snowshoe Fault, near its junction with the Rock Lake Fault. Numerous other diggings (generally shallow) occur along the northwest-trending faults that cut the area.

Three major deposits and a number of smaller deposits contain stratabound copper/silver mineralization. This mineralization was confined to the Revett Formation and situated within a narrow belt extending from the Coeur D'Alene Mining District north to approximately the Kootenai River. ASARCO brought one deposit, the 64-million-ton Spar Lake deposit (the Troy Mine)[2], into production in late 1981, producing approximately 4.2 million ounces of silver and 18,000 tons of copper per year. The 145-million-ton Rock Creek ore body in the CMW is the second deposit. In 1989, ASARCO acquired ownership of the deposit (1,809 acres) through the mineral patent process. ASARCO acquired surface ownership of only those portions of its 99 claims that lay outside the CMW (123 acres).

In 1983, U.S. Borax discovered another large stratabound ore body (Rock Lake deposit, 135 million tons) and later sold its interest in the deposit to Noranda. Borax maintains claims to three smaller copper/silver deposits that lie within the wilderness. All of these -- the Rock Peak, Horizon Basin, and Copper Gulch deposits -- are located around the periphery of ASARCO's Rock Creek ore body. Currently, Borax has no plans to develop these deposits.

Geologic History

The Cabinet Mountains and surrounding areas are composed of a thick series of metasedimentary rocks referred to as the Belt Supergroup. These Belt rocks were deposited in a subsiding basin about 1,450 to 850 million years ago (Harrison 1972). Originally deposited as a series of muds, silts, and sands, the deposits were metamorphosed to argillites, siltites, and quartzites, respectively. Belt rocks have been intruded by late-Precambrian- age dikes, sills, and other relatively small igneous bodies. The rocks have been extensively folded and faulted along generally northwest-trending structures (Hayes 1983).

Pleistocene-age glaciation (2 million to 10,000 years ago) sculpted the mountain peaks, overrode some lower elevation areas, and deposited a veneer of glacial deposits. Glacial lakebed deposits, silt and clay accumulations of 100 or more feet thick, were deposited in low-elevation drainages.

Geology of Project Area

A geologic bedrock and structure map of the proposed project area is presented in **Figure 3-2.**

Rock Creek Ore Body

The ore body crops out in two general areas. One area is in the North Basin, located north of Saint Paul Peak. The other area is on the south side of Saint Paul Peak, south of Milwaukee Pass and Cliff Lake. Bedrock exposed in the area consists primarily of the Revett and St. Regis formations. A small erosional remnant of the overlaying Wallace Formation caps Saint Paul Peak. The Burke Formation is exposed just to the south of the ore body outcrop in the southern portion of the area. The bedrock has been folded and cut by faults, the most prominent of which are the Copper Lake and Moran faults.

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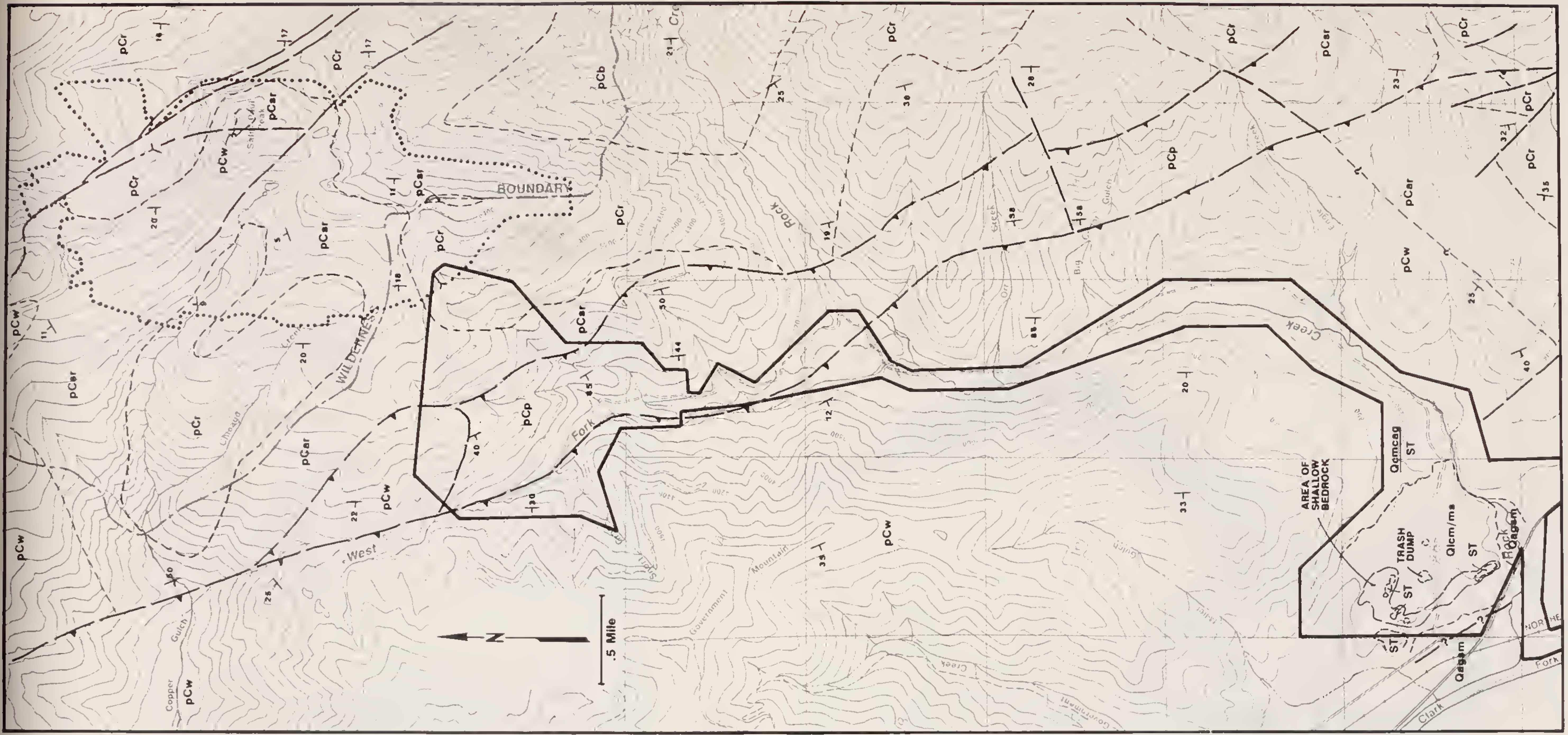
[2] The Troy Mine operated at a rate of about 8,500 tons per day (tpd) through the spring of 1993. It was then shut down and put on standby, with the hope of restarting just prior to the Rock Creek Project startup. ASARCO has stated that the reason for the shutdown was due to the combination of falling metal prices and the low grade of ore remaining at the mine.



Sources: ASARCO, Incorporated 1987-1994.

FIGURE 3-2
Bedrock and Geologic Strucure
Rock Creek Project

These steeply dipping, northwest-trending faults transect the ore body, breaking it into three segments. ASARCO refers to these segments, from southwest to northeast, as the Chicago Peak, Saint Paul, and North Basin blocks.

The ore body is at least 16,000 feet long and 7,200 feet wide and is elongate in a generally north-south direction, and rises and falls in excess of 500 feet within the stratagraphic horizon it occupies. Its elevation varies between approximately 6,000 feet at its highest to 4,300 feet at its lowest, with a gentle dip generally to the north and west. The ore body is situated primarily within quartzites of the lower Revett Formation, but it is also within siltites and argillites of the lower and middle Revett. The majority of the ore body is confined to one layer, but locally there may be up to four vertically stacked, potentially minable layers. The ore body ranges in thickness from about 6 feet up to a maximum of 235 feet. The average thickness is about 27 feet. It contains about 144 million tons of mineralized rock averaging 1.65 troy ounces silver per ton and 0.68 percent copper (ASARCO, Incorporated 1987-1994).

The majority of the ore body is covered by a thick layer of rock overburden. Typical overburden-to-ore thickness ratios exceed 15:1. The ratio is less than 15:1 only near the two outcrop areas and overlying a very thick ore zone near Copper Lake. The rock to be mined is generally strong and without any known fault gouge zones or other features that would suggest significant ground problems. Locally, the rocks are moderately to highly fractured, particularly adjacent to faults.

Whole Rock Analysis and Acid-Base Potential

The ore mineralization is stratabound within the Revett Formation and is tabular in shape and occurs within three mineralized zones. The principal ore minerals are bornite, chalcocite, occasional chalcopyrite (all copper-bearing minerals) and native silver. The mineralization most often occurs as fine-grained disseminations, with concentrations along fractures, veinlets, and bedding planes also common. Pyrite is not a constituent of the ore zones (Timothy Hayes, U.S. Geological Survey, in a letter to Rebecca Miller, March 6, 1995). Surrounding the ore zone is a zone of disseminated chalcopyrite, which in turn is surrounded, in places, by a zone of galena (lead mineral) and finally by a zone of pyrite (Balla 1984). All of these zones contain significant amounts of calcite and other minerals capable of neutralizing acid that might be formed from oxidation of pyrite (T. Hayes, pers. comm., March 6, 1995).

The mineral zonation patterns and mineral abundances both within the Rock Creek ore body and surrounding it has been observed in the Spar Lake deposit (ASARCO's Troy Mine) and in the Rock Lake deposit (Noranda's proposed Montanore Project), all three of which are within very similar rock types (quartzites, argillites, and siltites) of the Revett Formation. The geotechnical characteristics of the zonation pattern and mineral abundances of the deposits and surrounding zones are essentially indistinguishable (Hayes, pers. comm., March 6, 1995). Therefore, geochemical data from the Spar Lake and Rock Lake deposits can be relied upon for assessing potential impacts of mining the Rock Creek deposit.

Certain naturally occurring minerals, when disturbed by activities such as mining, may undergo a chemical weathering process (oxidation) and form acid. Other minerals in rocks have the ability to neutralize acid. For any given rock, the difference between the potential to produce acid and the potential to neutralize acid is the Net Neutralization Potential or acid-base potential. ASARCO has provided limited whole rock and acid-base accounting data for the Rock Creek ore body, choosing rather to depend on performance at their Troy Mine, Rock Creek acid-base accounting data are shown in **Table 4-13** (ASARCO, Incorporated 1992). As stated above, the lithologies, mineral abundances, and zonation patterns within and surrounding the Rock Creek, Spar Lake (Troy Mine), and Rock Lake ore bodies are very similar. Therefore, data from the Troy Mine and the Montanore Mine should be applicable. Waste rock and tailings from the Rock Creek Project should have very similar acid-base potential as Troy Mine waste rock and tailings, and as expected from Montanore Mine waste rock and tailings given the limited pyrite in the ore body and surrounding rock. An evaluation of acid rock drainage, based on data from all three projects, is presented in Chapter 4, Hydrology.

Tailings Impoundment

The tailings impoundment area consists mostly of surficial materials overlying shallow, eroded, and fractured bedrock of the Wallace Formation. Minor bedrock outcrops are exposed, primarily along the starter dike area. Colluvium covers the bedrock slopes at the back (north) of the impoundment area (Dames & Moore 1993).

Most of the surface material is composed of silts and clays deposited by glacial Lake Missoula. Alluvial deposits underlie and, in places, are interlayered with lakebed silts and clays. The depth of this unconsolidated material ranges from 0 feet, where bedrock is exposed, to over 85 feet. Clark Fork terrace alluvium is exposed immediately adjacent to and south of the impoundment area.

Earthquakes and Recent Faulting

The project area is situated within the Intermountain Seismic Belt, extending from southern Nevada northward through Utah, western Wyoming, and eastern Idaho into western Montana. This seismic belt is characterized by earthquakes of moderate-to-large magnitude with shallow focal depths.

The project site lies along the northern edge of the Lewis and Clark Line, a zone of major structural discontinuity bounded by the Hope Fault on the north. Structural styles and geology do not cross the line, and major seismic disturbance has occurred only south of the line within historic time (U.S. Army Corps of Engineers 1978). Historic seismicity indicates that the Sandpoint-Wallace end of the line, nearest Rock Creek, is less seismically active than the Helena end, but includes the seismically active St. Mary's trend.

Seismic zones most affecting the project area are associated with the northwest end of the Lewis and Clark Line and a northwest-trending zone near Flathead Lake. The latter zone is characterized by high levels of seismic activity and pre- to late Pleistocene, normal basin and range faulting.

Faults identified within the project area have no known recent (within the last 10,000 years) movement associated with them. The forces that formed these faults do not appear to be active; hence, they are not likely to generate an earthquake. However, earthquakes potentially could affect the site as a result of fault movement outside the project area.

The largest earthquake to occur in the Intermountain Seismic Belt was located near Hebgen Lake, Montana in 1959. This earthquake had a local magnitude of 7.1 (Richter Scale) and was located more than 300 miles from the site. It was probably perceptible in the study area but not with sufficient intensity to cause damage. The largest historic event in the northwest end of the Lewis and Clark Line was the Wallace earthquake (5.0 magnitude) of 1957, about 36 miles away. Several other close historic earthquakes ranged from about 15 to 45 miles away, occurring between 1918 and 1971. They all rated IV to VI on the Modified Mercali Intensity Scale. They were probably perceptible but not damaging at the site (ASARCO, Incorporated 1987-1994; Noranda Minerals Corp. 1989).

The buried trace of the inactive Hope Fault lies about 1,000 feet southwest of the proposed tailings impoundment area (Dames & Moore 1993). It is the largest fault in the region and is about 70 miles long, running from northern Idaho to near Missoula, Montana. There is no evidence of movement along the Hope Fault for the last 1 million years.

The Bull Lake Fault, about 18 miles to the northwest, shows evidence of movement within the last few hundred thousand years. Only the Rainy Creek Fault shows movement within the last 10,000 years. It is about 30 miles north of the impoundment area.

SOILS

Soils within the proposed permit area have developed since the last major climatic change, at least 10,000 years ago. This is enough time for soils to develop recognizable differences. Soils vary considerably in physical properties such as texture, coarse fragment content, depth, horizon sequence, organic matter content, and drainage. Some chemical characteristics, such as nutrient levels and soil reaction, vary widely, while others, such as conductivity, do not. This diversity in soil characteristics reflects the variability in parent materials, topography, microclimates, vegetation, and past land use practices. Generally, the soils are deep, relatively young, weakly developed, and mildly acidic due to coniferous vegetation that dominates in the area.

Within the proposed permit area, a total of 15 soil series were identified and placed into 23 mapping units (Noel *In* ASARCO, Incorporated 1987-1994). For the exploration adit area, two soil series were identified and placed into 12 mapping units (ASARCO, Incorporated 1992). Two disturbed land units, three talus, one rock outcrop, and a miscellaneous unit were also described. For ease of discussion, the soil mapping units have been grouped into three categories, based on similarities in the processes that deposited soil parent materials:

- colluvial/residual soils - derived from materials moved downhill by gravity or from rock that weathered in place;
- alluvial soils - derived from materials moved and deposited by flowing water; and
- lacustrine soils - derived from materials deposited by lakes, such as Glacial Lake Missoula.

Many of the soils in the study area, regardless of parent material, have a thin mantle of volcanic ash-influenced loess (wind blown deposits composed primarily of silt-sized particles), most of which was deposited about 6,800 years ago from volcanic eruptions in the Cascade Range. It is most evident on northerly and easterly aspects, gentle slopes, and protected benches. This material often differs sharply from the soil beneath it. Typically, the ash-influenced loess is nearly rock free, yellowish brown, and of a silt loam texture. The ash is noted because of its unique properties that favorably affect site productivity. These properties include low bulk density, high moisture-holding capacity, and high cation exchange capacity (the ability of soil to hold nutrients and make them available to plants) (Jones et al. 1979; Kuennen, Edson, and Tolle 1979; U.S. Forest Service 1972). However, these soils can be extremely susceptible to erosion. Soils derived from glacial till (material scoured and deposited by alpine glaciers) also occur in the permit area to a limited extent (Kuennen and Gerhardt 1984).

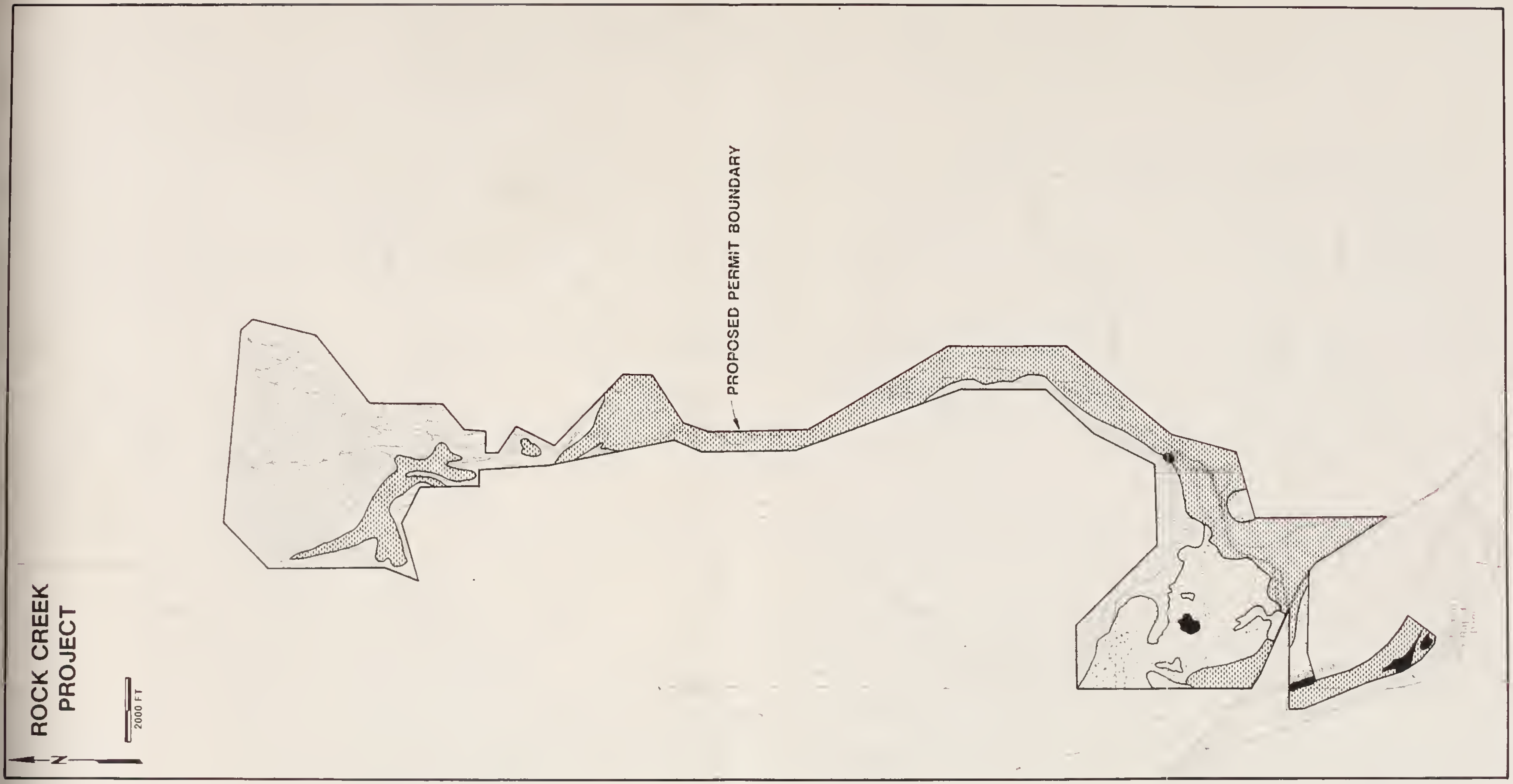
Figure 3-3 shows the distribution of these general soils groups within the proposed project area. Residual and colluvial soils have been combined into one unit. Disturbed areas are also shown and discussed.

Colluvial/Residual Soils

The colluvial/residual soils group contains 13 mapping units covering about 45 percent of the proposed permit area. These soils occur on steep and very steep slopes in the West Fork of Rock Creek and at the mouth of Rock Creek. The group also includes areas of bedrock outcrops and scree or talus (heaps of rock lying at angle-of-repose that have accumulated on steep slopes). There are also areas with soils derived from coarse-textured glacial till.

These soils are usually deep, often extending beyond 5 feet. Development, however, is confined to the upper 1 to 2 feet. Some soils, however, are very shallow and have bedrock within 5 inches of the soil surface. Surface soils with volcanic ash influence have loam and silt loam textures, while those without an ash influence generally have loam and sandy loam textures. Subsoil textures are usually sandy loams and loamy sands, regardless of ash influence. Coarse fragment content, by volume, is high and ranges from 50 to 70 percent gravels in the surface and from 60 to 90 percent shaly gravels, cobbles, and often boulders below. Rock content tends to be greater in soils lower on the slope than in soils higher on the slope except for soils in the exploration adit area that are extremely rocky throughout. Generally, surface soils have high susceptibility to erosion by water. The subsoils are moderately erodible, if disturbed.

Organic matter content is moderate in the surface but rapidly decreases to very low in the lower horizons. (A horizon is a soil layer that differs significantly from adjacent layers in terms of color, texture, or structure.) Soil reaction (pH) ranges from neutral (pH=7) to acid (pH=5). Horizons that are more developed (those with accumulations of clay or well-developed structure) tend to be less acidic (have higher pH). Extractable elemental metal concentrations are very low, with the exception of aluminum, which is slightly elevated in some soils. Aluminum concentrations are from natural soil processes and are not indicative of any influences of human activities, or from mineralization in the area.



▨ alluvial soils
☐ lacustrine soils
☐ colluvial / residual soils
■ disturbed areas

Sources: *Noel, Kuennen and Gerhardt 1984,*
ASARCO, Incorporated 1987-1994.

FIGURE 3-3
Permit Area Soils
Prock Creek Project

Alluvial Soils

These soils have developed in alluvium (materials deposited by moving water). The alluvial soils group contains eight mapping units covering about 40 percent of the proposed permit area. They occur on the floodplain terraces and slopes along Rock Creek, its tributaries, and the Clark Fork River.

These soils are deep, often extending beyond 5 feet. Most of the alluvial soils are well drained except for soils along lower Rock Creek, which are poorly drained. Soil development is confined to the upper 10 to 20 inches. Most of the alluvial soils have ash-influenced surfaces with silt loam and sandy loam textures. Gravel content ranges from 10 to 40 percent. Subsoil textures are loamy sands and sandy loams. Coarse fragment content, by volume, is high and ranges from 60 to over 90 percent rounded cobbles and gravels. Surface soils are highly erodible, if disturbed. Subsoils erodibility varies from high to low, if disturbed.

Organic matter content is high in ash-influenced surfaces, but rapidly decreases to very low in the lower horizons. Soil reaction ranges from slightly acid to strongly acid. Lower pHs are usually found in surface horizons. Extractable elemental metal concentrations are very low with the exception of aluminum, which is slightly elevated in some soils as a result of natural soil-forming processes in the area.

Lacustrine Soils

The lacustrine soils group contains two mapping units covering about 15 percent of the proposed permit area. These soils have developed in lacustrine materials (materials that were deposited in ancient Glacial Lake Missoula). They occur on the higher terraces and very gentle, protected slopes along lower Rock Creek close to its confluence with the Clark Fork River.

These soils are deep, often extending beyond 5 feet. They are moderately well drained but have slow to very slow permeability. Soil development is confined to the upper 10 to 20 inches. These soils have ash-influenced surfaces with silt loam and silty clay textures. The subsoils have silty clay or clay textures, often exceeding 50 percent. These soils are generally rock free throughout. The substratum is varved; that is, distinctly banded with thicker layers of silts and fine sands alternating with thinner layers of clays. Surface and subsurface soils are highly erodible, if disturbed.

Organic matter content, as with other soils in the project area, is high in ash-influenced surfaces, but rapidly decreases to very low in the lower horizons. Soil reaction ranges from slightly acid to very strongly acid. Lower pHs are usually found in lower horizons. Extractable elemental metal concentrations are very low with the exception of aluminum, which is slightly elevated in most samples.

Disturbed Areas

Disturbed areas occupy less than 0.1 percent of the proposed permit area. Included in this group are the old Noxon solid waste landfill and a gravel pit. The landfill has been reclaimed. The landfill is comprised of a mix of refuse and lacustrine soils. The landfill was capped with about 2 feet of lacustrine soils. Soil reactions in the landfill range from medium acid to neutral. Aluminum concentrations are slightly elevated in these materials, apparently attributable to the lacustrine soils.

HYDROLOGY

Surface Water

The Rock Creek drainage is located in northwestern Montana, southwest of the CMW. Rock Creek flows southwest for about 8 miles from Rock Lake to its confluence with the Clark Fork River at the head of Cabinet Gorge Reservoir, about 1 mile below Noxon Rapids Dam. The proposed mine and mill areas are drained by West Fork of Rock Creek. The proposed tailings impoundment site is drained by Miller Gulch. Surface water resources in the vicinity of the proposed project and selected surface water monitoring stations are presented in **Figure 3-4**.

The Rock Creek watershed encompasses about 33 square miles and is characterized by steep, deeply incised valleys and high mountain peaks with a maximum elevation over 7,700 feet. Seventy-two percent of the drainage is heavily forested. A significant portion of the remaining area was previously logged. In general, the highest streamflow runoff events are associated with winter or early spring rain-on-snow events. However, Rock Creek usually peaks in early- to mid-May. Representative streamflows for watersheds in the proposed project area are provided in **Table 3-2** and are discussed below.

West Fork Rock Creek

West Fork of Rock Creek is a perennial stream with a drainage area of about 6 square miles. However, during certain periods of the year, portions of the West Fork are dry. Near the southcentral edge of the proposed mill site, the West Fork is a high-gradient stream incised in a steeply sided bedrock canyon. Several springs on Snort Creek provide perennial flow to the West Fork of Rock Creek. Streamflow measurements taken simultaneously over a broad area indicate that the West Fork of Rock Creek loses water to the alluvial ground water system, particularly in its lower reach. During the winters of 1985, 1986, 1987, 1988, and 1989, the West Fork of Rock Creek was dry near the confluence with the East Fork (ASARCO, Incorporated 1987-1994). Flow data are available through August 1993.

East Fork Rock Creek

The upper East Fork drainage below Rock Lake contains a number of large ponds and marsh areas known as Rock Creek Meadows. The East Fork of Rock Creek is a perennial stream above its confluence with West Fork. Flow measurements at station ERC-1 during water year 1985 indicate that the East Fork contributed an average of 82 percent of the total flow of Rock Creek immediately below the confluence with the West Fork.

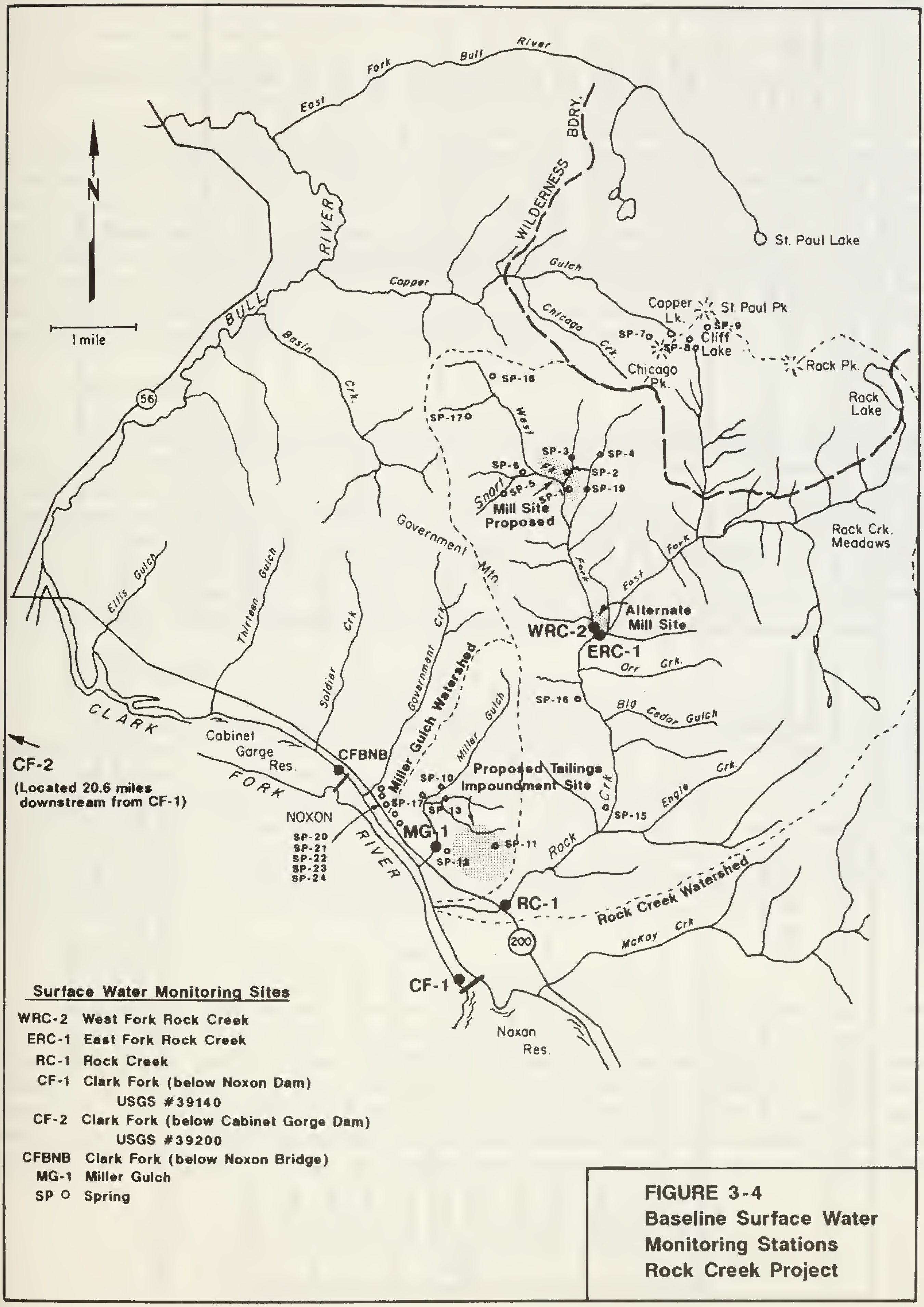


FIGURE 3-4
Baseline Surface Water Monitoring Stations
Rock Creek Project

TABLE 3-2.
Comparison of Streamflow Data at Selected Monitoring Stations

Daily Flow Data for Water Year 1986				Estimated Mean Monthly Flows			
Date	Rock Creek[1] RC-1 (cfs)	Clark Fork below Noxon Dam[2] CF-1 (cfs)	Clark Fork below Cabinet Gorge Dam[2] CF-2 (cfs)	Date	Rock Creek[3] RC-1 (cfs)	Clark Fork below Noxon Dam[4] CF-1 (cfs)	Clark Fork below Cabinet Gorge Dam[5] CF-2 (cfs)
10-16-85	15	14,900	15,000	October	16.3	11,600	11,900
11-20-85	8	18,000	18,500	November	4.1	12,100	12,600
12-09-85	Iced	21,200	19,400	December	1.7	14,000	13,900
01-15-86	Iced	11,900	12,200	January	1.9	14,900	14,200
02-15-86	Iced	15,900	16,400	February	2.4	16,200	14,700
03-05-86	99	26,600	30,200	March	40.5	18,100	15,600
04-09-86	159	32,300	20,500	April	145	24,200	24,600
05-03-86	143	26,500	29,500	May	340	44,600	51,200
06-16-86	145	38,100	41,200	June	310	57,000	59,400
07-25-86	8	10,500	12,600	July	27	24,700	27,000
08-20-86	1.1	9,620	11,600	August	1.6	10,300	11,500
09-12-86	Dry	12,800	12,700	September	Dry	9,840	10,400
				ANNUAL	81.0	21,462	22,250

Sources and Notes:

[1] ASARCO, Incorporated 1987-1994.

[2] U.S. Geological Survey 1988 unpublished data

[3] Estimated for water year 1986 using Riggs Methodology (Riggs 1968)

[4] Water years 1961-1979 (USGS unpublished data)

[5] Water years 1929-1988 Flow below Cabinet George Dam provides an estimate of the inflow to Lake Pend Oreille.

Mainstem Rock Creek

The proposed mine access corridor would parallel the main stem of Rock Creek. Rock Creek is characterized by high velocities and large flow volumes during snowmelt runoff. Below the confluence of the East and West forks, the flow in Rock Creek often sinks into the coarse alluvial material during low-flow periods. Perennial flow occurs for about 1 mile above the constriction at the lower canyon outlet; low flows are lost into alluvium several hundred yards above Montana Highway 200. Rock Creek, at station RC-1, was dry for several months during the winter of 1984-1985 and fall of 1986, 1987, 1988, and 1989. Summer low flow at RC-1 was about 2 cubic feet per second (cfs). Peak flow during the baseline period of measurement was estimated to be about 200 to 300 cfs. The 7-day, 10-year low flow ($Q^{7,10}$) is equal to 0.0 cfs. Flow data are available through August 1993.

Miller Gulch

The proposed tailings impoundment would be located primarily within the Miller Gulch drainage. The north fork of Miller Gulch drains the south slope of Government Mountain. The south fork drains a terrace associated with the Clark Fork River. Base flow in Miller Gulch is maintained by a major spring located just above the Clark Fork River terrace. After passing through a series of beaver ponds, Miller Gulch loses flow to ground water and is generally dry except for intermittent high-flow periods that occur during snowmelt runoff. The largest recorded flow in Miller Gulch at station MG-1 was about 1.7 cfs (ASARCO, Incorporated 1987-1994). Flow in Miller Gulch is currently diverted for power generation (DNRC Permit #PO29428), and for irrigation (DNRC Claim #W131972).

Clark Fork River and Lake Pend Oreille

Rock Creek and Miller Gulch drain to the Clark Fork River about 6 miles south of the proposed mill site. The Clark Fork then flows northwestward for about 30 miles to Lake Pend Oreille in Idaho and provides the majority of inflow (80 to 90 percent) to the lake. Streamflow in the Clark Fork River is regulated by Noxon Rapids Dam about 1 mile upstream from the confluence of Rock Creek and the Clark Fork, and also by Cabinet Gorge Dam in Idaho. During water year 1986, Rock Creek provided only 0.4 percent of the total flow of the Clark Fork River below Noxon Dam. A comparison of flows for the Clark Fork River upstream and downstream of Rock Creek, and at the mouth of Rock Creek, is presented in **Table 3-2**. The $Q^{7,10}$ is equal to 3,100 cfs.

Cabinet Mountains Wilderness (CMW)

A number of ponds and small lakes exist in the CMW in the vicinity of the ore body. These include Copper, Cliff, Saint Paul, Rock, and Moran Basin lakes. Cliff Lake contributes to the headwaters of East Fork of Rock Creek. Copper, Saint Paul, and Moran Basin lakes are located in the Bull River drainage. All four lakes retain water year-round; however, outflows are intermittent or nonexistent during drier years. Fluctuations of 0.5 feet in lake surface elevation in Cliff and Copper lakes were measured during water year 1981. Approximately 50 percent of the lakebed associated with Copper Lake was dry during the summer of 1988. No outflows were observed from these lakes in August 1985.

Flows in Copper Gulch ranged between 18.96 cfs and 3.54 cfs on June 9, 1977 and September 11, 1978, respectively.

Surface Water Quality

Existing water resources data for the period of record (1984 through 1990) are summarized in this draft EIS, and are useful for the purpose of characterizing baseline hydrology (ASARCO, Incorporated 1987-1994; Department of Health and Environmental Sciences 1993; U.S. Geological Survey 1988; ASARCO, Incorporated 1993). **Tables 3-3 and 3-4** provide water quality data for Rock Creek at a monitoring station located at Montana Highway 200. **Tables 3-5 and 3-6** present data for the Clark Fork River at Noxon Bridge, and **Table 3-7** summarizes data for the Clark Fork River below Cabinet Gorge Dam. These data represent water quality baseline conditions.

Baseline water quality monitoring data can be compared to state and/or federal water quality criteria for public drinking water, recreation, aquatic life, irrigation, and livestock watering. According to the Montana Water Quality Division (WQD) stream classification, Rock Creek and the Clark Fork River below Noxon Dam are classified B-1 (ARM 16.20.618)[3]. Water quality data for selected streams in the proposed project area for the period of record are summarized in **Table 3-8** and are discussed below.

Under the federal Clean Water Act, states are required to report to EPA a list of water bodies or portions thereof that are water quality-limited, that is that do not meet applicable water quality standards. These water bodies, as well as water bodies that do not fully support their designated beneficial uses, are identified in the Montana 305(b) Report (Department of Health and Environmental Sciences 1994a). Section 303(d) of the federal Clean Water Act further requires that streams for development of a total maximum daily load (TMDL). The TMDL calculation determines the allowable pollutant load, from all sources, that a water body can assimilate and not violate the applicable water quality standard.

Rock Creek (MT76N003-19) is listed as a moderate priority for development of a TMDL due to the potential for water quality degradation associated with the ASARCO Rock Creek project. The Clark Fork River, from Warm Springs Creek to the confluence of the Flathead River, is listed as a high priority for TMDL development due to excessive nutrient loads and other sources of impairment. In addition, 97 miles of the Clark Fork below the confluence with the Flathead River to the Idaho border are listed as partially supporting aquatic life and cold-water fisheries due to flow alternation and thermal modifications resulting from dam operation and construction but is not listed as requiring a TMDL.

Rock Creek

Rock Creek is characterized by soft (low hardness), calcium-bicarbonate water with low or nondetectable levels of oil and grease, nutrients, and metals. During the baseline period of measurement,

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[3] B-1 water quality standards may be obtained from the WQD.

TABLE 3-3.
Water Quality Data for Rock Creek at Highway 200
December 1988 Through August 1993

Parameter	Number Of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	53	7.6	0.27	8.02	6.75
Total Suspended Solids	15	3.0	4.3	16.0	<0.1
Total Hardness (as $CaCO_3$)	55	10	9	72	2
Total Alkalinity (as $CaCO_3$)	53	11	5	20	<5.0
Ammonia (NH_3 as N)	33	<0.01	0.0	<0.01	<0.01
Total Kjeldahl Nitrogen (as N)	33	0.08	0.17	0.70	<0.1
Nitrate + Nitrite (as N)	33	0.02	0.018	0.70	<0.01
Orthophosphate (PO_4-P)	33	<0.001	0.0011	0.006	<0.001
Total Phosphorus	33	0.006	0.0079	0.048	<0.001
Arsenic TR	56	<0.001	0.000132	0.001	<0.005
Cadmium TR	56	<0.0002	0.000078	0.0004	<0.001
Copper TR	56	<0.001	0.0	<0.01	<0.01
Lead TR	56	<0.001	0.000265	0.002	<0.01
Zinc TR	56	0.0005	0.0025	0.011	<0.005

Source: Montana Department of Health and Environmental Sciences, Water Quality Bureau, 1994.

Notes: All units are in milligrams per liter (mg/L) unless otherwise indicated.
SU = Standard pH Units
TR = Total Recoverable Metals Analysis

TABLE 3-4.
Water Quality Data For Rock Creek At Highway 200 November, 1984 Through August, 1993

Parameter	Number of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	35	7.12	0.38	7.7	5.9
Total Suspended Solids	30	2.9	5.8	33.0	<1.0
Total Hardness (as $CaCO_3$)	28	10.1679	2.7813	17.0000	5.0000
Total Alkalinity (as $CaCO_3$)	30	10.7067	3.5760	21.0000	3.5000
Sulfate (SO_4)	27	ND	ND	5.0000	<1.0000
Ammonia (NH_3 as N)	34	ND	ND	3.0000[1]	<0.0100
Total Kjeldahl Nitrogen (as N)	37	ND	ND	5.1000[1]	<0.0100
Nitrate and Nitrite (as N)	37	1.4401	3.1393	12.6000[1]	0.0020
Orthophosphate (PO_4-P)	30	ND	ND	<0.0500	<0.0010
Total Phosphorus	34	ND	ND	<0.0030	0.0020
Arsenic (DIS)	1	ND	ND	<0.0080	<0.0080
Arsenic (TRC)	37	ND	ND	0.0050	<0.0010
Cadmium (DIS)	1	ND	ND	<0.0030	<0.0040
Cadmium (TRC)	27	0.0002	0.0002	0.0009	<0.0001
Chromium (DIS)	1	ND	ND	<0.0300	<0.0300
Chromium (TOT)	2	ND	ND	<0.0100	<0.0100
Chromium (TRC)	27	ND	ND	<0.3000	<0.0100
Copper (DIS)	1	ND	ND	<0.0080	<0.0080
Copper (TRC)	33	ND	ND	<0.0100	<0.0010
Iron (DIS)	1	0.0700	0.0000	0.0700	0.0700
Iron (TRC)	25	0.0512	0.0770	0.3800	<0.0080
Lead (DIS)	1	ND	ND	<0.0200	<0.0200
Lead (TRC)	34	ND	ND	0.0070	<0.0010
Manganese (DIS)	1	ND	ND	<0.0080	<0.0080
Manganese (TRC)	33	ND	ND	0.0180	<0.0008
Mercury (DIS)	2	ND	ND	<0.0005	<0.0030
Mercury (TRC)	23	ND	ND	<0.0005	<0.0001
Selenium (DIS)	2	ND	ND	ND	ND
Selenium (TRC)	18	ND	ND	0.0060	<0.0040
Silver (DIS)	1	ND	ND	<0.0080	<0.0080
Silver (TRC)	34	ND	ND	0.0129	<0.0002
Zinc (DIS)	1	0.0380	0.0000	0.0380	0.0380
Zinc (TRC)	26	0.0038	0.0053	0.0220	<0.0010

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
TOT = Total Metals Analysis
DIS = Dissolved Metals Analysis
NC = No average calculated if at least 50% of the data set is below detection
TRC = Total Recoverable Metals Analysis
ND = No Data
[1] = May be biased high due to error in laboratory analysis. Compare with Table 3-3.

TABLE 3-5.
Water Quality Data for Clark Fork River at Noxon Bridge July 1984 Through August 1992

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	108	8.09	0.23	8.45	7.12
Total Suspended Solids	123	2.5	2.6	16.9	0.2
Total Hardness (as $CaCO_3$)	124	85.7	12.4	105	39
Total Alkalinity (as $CaCO_3$)	105	80.7	10.5	99	57
Ammonia (NH_3 as N)	125	0.0056	0.0114	0.07	<0.1
Total Kjeldahl Nitrogen	124	0.1419	0.1063	0.6	<0.1
Nitrate + Nitrite	124	0.0273	0.0226	0.11	<0.01
Orthophosphate (PO_4-P)	125	0.003	0.0041	0.035	<0.001
Phosphorus (P) TR	124	0.011	0.0087	0.062	<0.001
Arsenic TR	63	0.0003	0.0005	0.002	<0.005
Cadmium TR	57	0.000642	0.002119	0.015	<0.001
Copper TR	123	0.0003	0.0014	0.013	<0.01
Lead TR	65	0.0002	.0006	0.003	<0.01
Zinc TR	124	0.0031	0.0058	0.041	<0.005

Source: Montana Department of Health and Environmental Sciences, Water Quality Bureau 1994.

Notes: All units are in milligrams per liter (mg/L) unless otherwise indicated.
Less than detection limit values assumed to be zero for statistical analyses.
SU = Standard pH Units
TR = Total Recoverable Metals Analysis

TABLE 3-6.
Water Quality Data for Clark Fork River at Noxon Bridge

Parameter	Number Of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	3	7.8667	0.1155	8.0000	7.8000
Total Suspended Solids	[illegible]	1.5333	0.2082	1.70000	1.3000
Total Hardness (as $CaCO_3$)	3	89.0000	13.8924	98.0000	73.0000
Total Alkalinity (as $CaCO_3$)	3	77.6667	10.2144	85.0000	66.0000
Sulfate SO_4	3	ND	ND	4.5000	<2.0000
Ammonia (NH_3 as N)	3	ND	ND	<0.1000	<0.1000
Total Kjeldahl Nitrogen (as N)	[illegible]	ND	ND	0.1200	<0.1000
Nitrate and Nitrite (as N)	3	0.0833	0.0416	0.1300	<0.1000
Orthophosphate (PO_4-P)	3	ND	ND	<0.0500	<0.0200
Total Phosphorus	3	ND	ND	<0.1000	0.0500
Arsenic (DIS)	0	ND	ND	ND	ND
Arsenic (TRC)	3	ND	ND	0.0010	<0.0010
Cadmium (DIS)	0	ND	ND	ND	ND
Cadmium (TRC)	2	ND	ND	<0.0001	<0.0001
Chromium (DIS)	3	ND	ND	ND	ND
Chromium (TRC)	2	ND	ND	<0.0100	<0.0100
Copper (DIS)	0	ND	ND	ND	ND
Copper (TRC)	3	ND	ND	<0.0010	<0.0010
Iron (DIS)	0	ND	ND	ND	ND
Iron (TRC)	3	0.0400	0.0263	0.0700	0.0210
Lead (DIS)	0	ND	ND	ND	ND
Lead (TRC)	[illegible]	ND	ND	<0.0010	<0.0010
Manganese (DIS)	0	ND	ND	ND	ND
Manganese (TRC)	[illegible]	ND	ND	<0.0080	<0.0080
Mercury (DIS)	0	ND	ND	ND	ND
Mercury (TRC)	3	ND	ND	<0.00[illegible]	<0.0005
Selenium (DIS)	0	ND	ND	ND	ND
Selenium (TRC)	2	ND	ND	<0.0050	<0.0080
Silver (DIS)	3	ND	ND	ND	ND
Silver (TRC)	[illegible]	ND	ND	<0.0010	<0.0002
Zinc (DIS)	0	ND	ND	ND	ND
Zinc (TRC)	2	0.0070	0.0071	0.0120	0.0020

Source: ASARCO, Incorporated, 1987-1994.

Notes: All units are in mg/L unless otherwise indicated.

Period of Record is from April 1990 through October 1991.

SU = Standard pH Units
TRC = Total Recoverable Metals Analysis
DIS = Dissolved Metals Analysis
ND = No Data
NC = No average calculated if at least 50% of the data set is below detection.

TABLE 3-7.
Water Quality Data for Clark Fork River below Cabinet Gorge Dam July 1984 Through August 1992

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	124	8.1	0.22	8.53	7.44
Total Suspended Solids	122	2.4	2.7	18.7	0.3
Total Hardness (as $CaCO_3$)	125	84.3	11.9	104	60
Total Alkalinity (as $CaCO_3$)	106	79.7	10.4	97	54
Ammonia (NH_3 as N)	124	0.0031	0.0085	0.06	<0.01
Total Kjeldahl Nitrogen (as N)	124	0.148	0.1333	0.7	<0.1
Nitrate + Nitrite (as N)	124	0.025	0.0224	0.12	<0.01
Orthophosphate (PO_4-P)	106	0.0021	0.0039	0.036	<0.001
Phosphorus TR	124	0.0099	0.0067	0.047	<0.001
Arsenic TR	36	0.0003	0.0005	0.002	<0.005
Cadmium TR	65	0.000003	0.000025	0.0002	<0.001
Copper TR	124	0.0002	0.0011	0.011	<0.01
Lead TR	66	0.0001	0.0005	0.003	<0.01
Zinc TR	125	0.002	0.0035	0.02	<0.005

Source: Montana Department of Health and Environmental Sciences, Water Quality Bureau 1994.

Notes: All units are in milligrams per liter (mg/L) unless otherwise indicated.
Less than detection limit values assumed to be zero for statistical analyses.
SU = Standard pH Units
TR = Total Recoverable Metals Analysis

TABLE 3-8.
Range of Concentrations for Surface Water Monitoring Stations

Location	West Fork Rock Creek	East Fork Rock Creek	Miller Gulch	Rock Creek	Clark Fork below Noxon
Period of Record	11/84-8/93	2/85-8/93	4/85-8/93	9/84-8/93	4/90-10/91
Flow CFS	0.0450 - 50.2800	0.5900 - 174.0000	0.0180 - 1.7000	0.5200 - 400.0000	ND
pH (SU)	6.9000 - 8.1000	5.9000 - 7.8000	7.0000 - 8.2000	5.9000 - 7.7000	7.800 - 8.0000
Total Suspended Solids	<1.000 - 31.0000	0.3000 - 2.0000	<1.0000 - 1.6000	<1.0000 - 33.0000	1.3000 - 1.7000
Hardness (as $CaCO_3$)	24.0000 - 44.0000	2.6000 - 6.8000	70.0000 - 187.0000	5.0000 - 17.0000	73.0000 - 98.0000
Alkalinity (as $CaCO_3$)	25.0000 - 47.0000	<1.0000 - 12.0000	69.0000 - 178.0000	3.5000 - 21.0000	66.0000 - 85.0000
Sulfate (SO_4)	<1.0000 - <10.0000	<1.0000 - 4.4000	<2.0000 - 9.3000	<1.0000 - 5.0000	<2.0000 - 4.5000
Ammonia (NH_3 as N)	<0.0100 - 1.2600[1]	<0.0100 - 0.3500[a]	<0.0100 - <0.0500[a]	<0.0100 - 3.0000[a]	<0.1000 - <0.1000
Total Kjeldahl Nitrogen (as N)	<0.0100 - 1.5000[1]	<0.0100 - 0.4100[a]	<0.0100 - 0.2500[a]	<0.0100 - 5.1000[a]	<0.1000 - 0.1200
Nitrate and Nitrite (as N)	<0.0100 - 13.0000[1]	<0.0100 - 10.0000[a]	0.2500 - 12.0000[a]	0.0020 - 12.6000[a]	<0.1000 - 0.1300
Orthophosphate (PO_4-P)	<0.0010 - <0.0500	<0.0100 - <0.0500	<0.0100 - 0.0160	<0.0010 -<0.0500	<0.0200 - <0.0500
Phosphorus (P) (TOT)	0.0040 - <0.1000	<0.0100 - 0.0600	<0.0100 - 0.0300	0.0020 - <0.1000	<0.0500 - <0.1000
Arsenic (DIS)	<0.0080 - <0.0080	ND	ND	<0.0080 - <0.0080	ND
Arsenic (TRC)	<0.0010 - <0.0040	<0.0010 - 0.0050	<0.0010 - <0.0040	<0.0010 - 0.0050	<0.0010 - 0.0010
Cadmium (DIS)	<0.0030 - <0.0030	ND	ND	<0.0030 - <0.0030	ND
Cadmium (TRC)	<0.0001 - 0.0019	<0.0001 - 0.0016	<0.0001 - 0.0004	<0.0001-0.0009	<0.0001 - <0.0001
Chromium (DIS)	<0.0300 - <0.0300	ND	ND	<0.0300 - <0.0300	ND
Chromium (TRC)	<0.0100 - <0.3000	<0.0100 - <0.3000	<0.0100 - <0.0300	<0.0100 - <0.3000	<0.0100 - <0.0100
Copper (DIS)	<0.0080 - <0.0080	ND	ND	<0.0080 - <0.0080	ND
Copper (TRC)	<0.0010 - 0.0100	<0.0010 - 0.0010	<0.0010 - 0.0010	<0.0010 - <0.0100	<0.0010 - 0.0010
Iron (DIS)	0.0700 - 0.0700	ND	ND	0.0700 - 0.0700	ND

TABLE 3-8 (Cont.)
Range of Concentrations for Surface Water Monitoring Stations

Location	West Fork Rock Creek	East Fork Rock Creek	Miller Gulch	Rock Creek	Clark Fork below Noxon
Period of Record	**11/84-8/93**	**2/85-8/93**	**4/85-8/93**	**9/84-8/93**	**4/90-10/91**
Iron (TRC)	0.0020 - 0.1200	<0.0050 - 0.0240	<0.0050 - 0.0450	<0.0050 - 0.3800	0.0210 - 0.0700
Lead (DIS)	<0.0200 - <0.0200	ND	ND	<0.0200 - <0.0200	ND
Lead (TRC)	<0.0010 - 0.0070	<0.0010 - 0.0050	<0.0010 - 0.0010	<0.0010 - 0.0070	<0.0010 - <0.0010
Manganese (DIS)	0.0120 - 0.0120	ND	ND	<0.0080 - <0.0080	ND
Manganese (TRC)	<0.0010 - 0.0080	<0.0080 - 0.0180	<0.0080 - 0.0080	<0.0008 - 0.0180	<0.0080 - <0.0080
Mercury (DIS)	<0.0002 - <0.0005	ND	ND	<0.0005 - <0.0005	ND
Mercury (TRC)	<0.0001 - <0.0005	<0.0001 - <0.0005	<0.0005 - <0.0005	<0.0001 - <0.0005	<0.0005 - <0.0005
Selenium (DIS)	ND	ND	ND	ND	ND
Selenium (TRC)	<0.0040 - <0.0050	<0.0040 - 0.0080	<0.0040 - <0.0040	<0.0040 - 0.0060	<0.0050 - <0.0050
Silver (DIS)	<0.0080 - <0.0080	ND	ND	<0.0080 - <0.0080	ND
Silver (TRC)	<0.0002 - 0.0065	<0.0002 - 0.0012	<0.0002 - <0.0010	<0.0002 - 0.0129	<0.0002 - <0.0010
Zinc (DIS)	0.0220 - 0.0220	ND	ND	0.0380 - 0.0380	ND
Zinc (TRC)	<0.0010 - 0.0380	<0.0010 - 0.0040	<0.0010 - <0.0010	<0.0010 - 0.0220	0.0020 - 0.0120

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise noted.
SU = Standard pH Units
DIS = Dissolved Metals Analysis
TRC = Total Recoverable Metals Analysis
ND = No Data
[1] = Concentrations may be biased high due to laboratory error (See Table 3-3).

the average hardness of water in Rock Creek was about 10 milligrams/liter(mg/L). Turbidity is extremely low, with total suspended sediment generally less than 1 mg/L. At high flow, the concentration of suspended sediment approaches 8 mg/L. All water quality constituents are well within the range of concentrations established to protect uses such as drinking water, recreation, irrigation, and livestock watering. The concentrations of cadmium, copper, lead, and zinc at times exceeded numeric water quality standards during the baseline period of measurement. This is due to the extremely low hardness in Rock Creek. Despite the existing water quality and occasional high levels of some metals, a self-supporting salmonid fishery (beneficial use) is present and appears to be limited mainly by the amount of habitat with perennial flows.

Miller Gulch

Miller Gulch contains hard, calcium-bicarbonate water with low or nondetectable levels of oil and grease, nutrients, and metals. Concentrations of these constituents are below criteria established to protect drinking water supplies, recreation, irrigation, and livestock watering. Chronic cold-water aquatic life criteria occasionally were exceeded for cadmium and silver during the period of baseline measurement.

Clark Fork River

Several stations on the lower Clark Fork River have been sampled on a periodic basis by the Montana WQD, ASARCO, and U.S. Geological Survey (USGS). Water quality results from station CF-1 located below Noxon Dam and at station CF-2 located below Cabinet Gorge Dam indicate a moderately hard water (61 to 100 mg/L), with concentrations of metals that are generally below water quality criteria. Nitrate plus nitrite as nitrogen range between less than 0.01 and 0.13 mg/L.

Cabinet Mountains Wilderness

Limited water quality data have been collected from water resources located in the CMW. **Table 3-9** presents a summary of available water quality data for Cliff and Copper lakes, Copper Gulch, and a number of unnamed springs. Water collected at these sites is characterized by neutral pH, low specific conductance, metals that are at or below the analytical detection limit, and total dissolved solids that range between 11 and 12 mg/L.

Ground Water

Baseline data suggest that significant quantities of ground water may be found in coarse gravel and sand deposits associated with Rock Creek and the Clark Fork River. However, monitoring wells completed in fine-grained glacial lakebed sediments (lacustrine deposits) in the vicinity of the Clark Fork River typically yield very little water or are dry. Ground water movement in bedrock is primarily controlled by weathering or the existence of joints, fractures, or faults. In general, ground water flows from topographically high areas in the mountains to lower valleys.

TABLE 3-9.
Water Quality Data for Water Resources Located in the Cabinet Mountains Wilderness

Location	Date Sampled	Total Dissolved Solids (mg/L)	Specific Conductance (μmhos/cm)	pH (Standard Units)	As (TRC) (mg/L)	Cd (TRC) (mg/L)	Cd (TRC) (mg/L)	Zn (TRC) (mg/L)
Spring below Chicago Peak	08-02-85	ND	27	7.7	ND	ND	ND	ND
Spring below St. Paul Peak	08-02-85	ND	123	6.5	ND	ND	ND	ND
Stream below Cliff Lake	08-05-85	ND	8	7.8	ND	ND	ND	ND
Copper Gulch	06-09-77 09-11-78	 85	62 110	7.7 8.2	ND	ND	ND	ND
Stream below St. Paul Lake	08-07-85	ND	22	7.4	ND	ND	ND	ND
Cliff Lake	10-23-81 09-23-82 08-02-85	11 12	16 21 15	7.4 7.0 7.4	0.0001 <0.0001	0.003 <0.002	0.003 <0.002	<0.004 <0.004
Copper Lake	08-02-85	ND	8	7.0	ND	ND	ND	ND

Source: ASARCO, Incorporated 1987-1994.

Notes:

As = Arsenic
Cd = Cadmium
Cu = Copper
Zn = Zinc
TRC = Total Recoverable Metals Analysis
ND = No Data Available

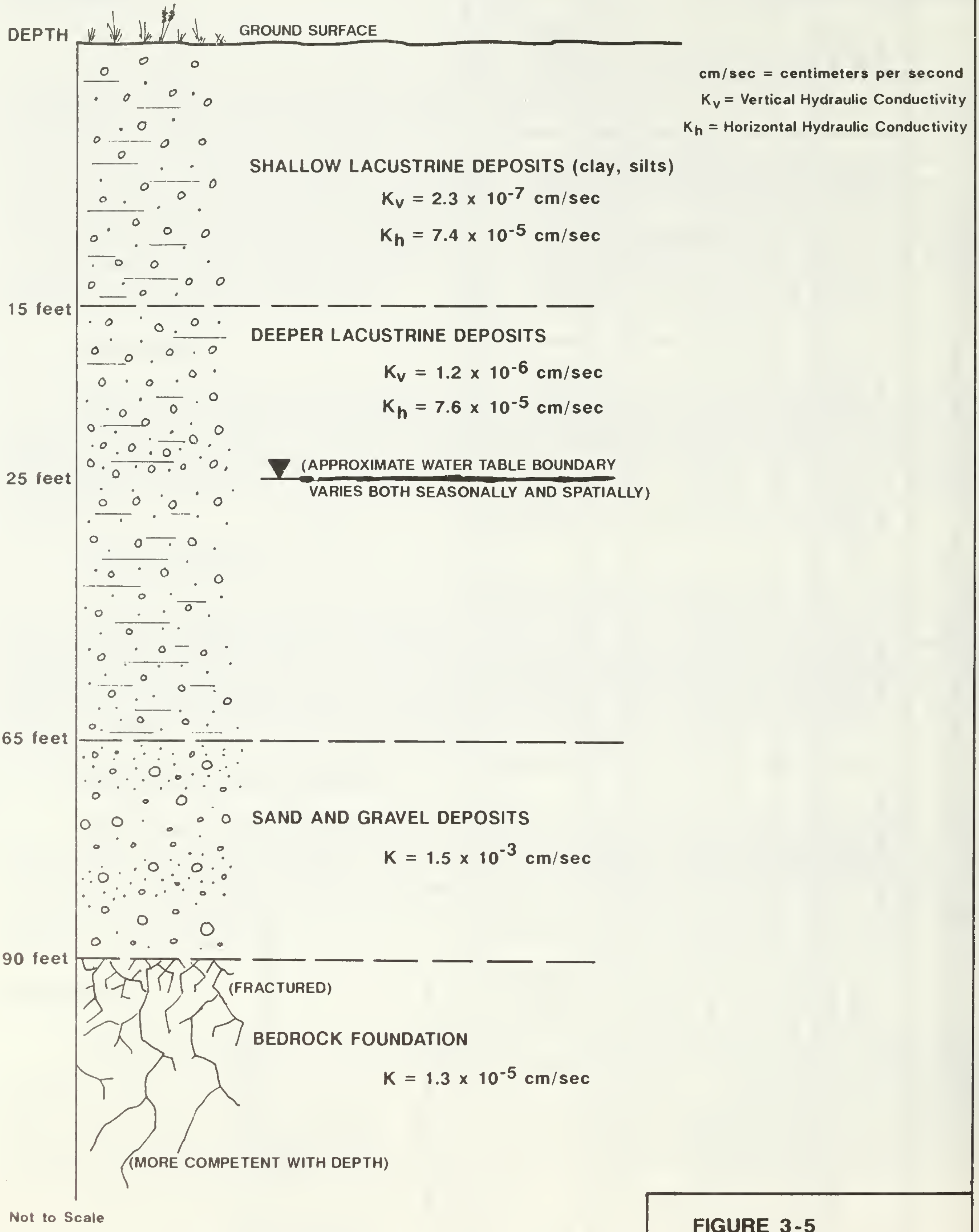

DEPTH
GROUND SURFACE
cm/sec = centimeters per second
K_v = Vertical Hydraulic Conductivity
K_h = Horizontal Hydraulic Conductivity
SHALLOW LACUSTRINE DEPOSITS (clay, silts)
$K_v = 2.3 \times 10^{-7}$ cm/sec
$K_h = 7.4 \times 10^{-5}$ cm/sec
15 feet
DEEPER LACUSTRINE DEPOSITS
$K_v = 1.2 \times 10^{-6}$ cm/sec
$K_h = 7.6 \times 10^{-5}$ cm/sec
25 feet
(APPROXIMATE WATER TABLE BOUNDARY
VARIES BOTH SEASONALLY AND SPATIALLY)
65 feet
SAND AND GRAVEL DEPOSITS
$K = 1.5 \times 10^{-3}$ cm/sec
90 feet
(FRACTURED)
BEDROCK FOUNDATION
$K = 1.3 \times 10^{-5}$ cm/sec
(MORE COMPETENT WITH DEPTH)
Not to Scale

FIGURE 3-5
Hydraulic Conductivity
Rock Creek Project

Adapted from information provided by ASARCO, Incorporated, 1987-1994.

The three major areas of the proposed project where ground water may be encountered include coarse sediments below the proposed tailings impoundment site and mill site, and the bedrock in the ore body. The hydrogeology of each of these areas is discussed below.

Hydrogeologic conditions in the vicinity of the proposed tailings impoundment site were determined from 19 geotechnical borings and monitoring wells, and are presented schematically in **Figure 3-5**. Soil boring data indicate that the site is underlain by up to 65 feet of lacustrine clays, sands, and silts, which in turn are underlain by up to 25 feet of sand and gravel. Below the sand and gravel layer is argillitic bedrock. However, the actual thickness of unconsolidated deposits is highly variable. In addition, the hydraulic conductivity (the ability to transmit water) of each stratum varies both with location and depth.

Proposed Tailings Impoundment Site

Estimates of the vertical and horizontal hydraulic conductivity for lacustrine deposits of clay, sand, and silt; for sand and gravel deposits; and for the bedrock formation are also presented in **Figure 3-5**. Ground water in unconsolidated deposits is generally unconfined, that is, the water table forms the upper boundary of the aquifer. **Figure 3-6** indicates that the depth to ground water is about 25 feet below ground surface (also see **Figure 3-5**). The actual depth to ground water ranges from 2 to 35 feet below ground surface, and fluctuates seasonally up to about 8 feet, with highest levels occurring in the spring followed by lower levels during late fall and early winter. Water quality data from lacustrine wells are provided in **Table 3-10**. **Table 3-11** summarizes water quality data from sand and gravel wells.

A conceptual model of ground water flow in the vicinity of the proposed impoundment site is presented in both plan view and cross-section in **figures 3-6 and 3-7**, respectively.

Low permeabilities associated with clayey lacustrine deposits impede, or at least minimize, the downward flow of ground water to the more permeable sandy and gravelly strata. It is estimated that ground water flows west towards the Clark Fork River at a rate of 0.2 feet per day in unconsolidated lacustrine deposits and at about 8.5 feet per day in the underlying sand and gravel deposits. Ground water can be expected to flow toward the Clark Fork River.

Proposed Mill Site

The proposed mill site is located in the upper West Fork of Rock Creek drainage. Unconsolidated valley fill consisting of up to 200 feet of alluvium, glacial moraine material, and colluvium overlie a steeply dipping argillite and quartzite bedrock. The average hydraulic conductivity (ability to transmit water) of the unconsolidated material is estimated to be about 16 feet per day, representative of sand, or sand and fine gravel material (ASARCO, Incorporated 1987). Baseline data indicate that the hydraulic gradient is about 0.10 feet per foot. The rate of ground water flow is about 8 feet per day. **Figure 3-8** presents information related to the hydrogeology in the vicinity of the proposed mill site. Water quality data from the proposed and alternate mill site are provided in **tables 3-12 and 3-13**, respectively.

TABLE 3-10.
Ground Water Quality at Proposed Tailings Impoundment Site Lacustrine Wells

Parameter	Number of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	14	7.9286	0.4730	8.6	6.9
Total Suspended Solids	14	31515	39722.	300360.000	37.0000
Total Hardness (as $CaCO_3$)	14	269.8571	68.6057	387.0000	175.0000
Total Alkalinity (as $CaCO_3$)	14	1158.0000	3078.3395	11850.0000	182.0000
Sulfate (SO_4)	14	7.2857	6.6954	26.0000	<3.0000
Ammonia (NH_3 as N)	13	0.6200	1.0493	7.5000	<0.0200
Total Kjeldahl Nitrogen (as N)	13	1.3319	2.0688	7.5000	<0.0100
Nitrate and Nitrite (as N)	13	ND	ND	3.3000	<0.0100
Orthophosphate (PO_4-P)	14	ND	ND	0.0360	<0.0100
Total Phosphorus	14	2.0868	3.5638	11.0000	<0.0500
Arsenic (DIS)	13	0.0085	0.0061	0.0220	<0.0040
Arsenic (TRC)	1	0.0030	0.0000	0.04[illegible]0	0.0030
Cadmium (DIS)	13	0.0013	0.000[illegible]	0.00[illegible]0	<0.0001
Cadmium (TRC)	1	0.0002	0.0000	0.0002	0.0002
Chromium (DIS)	16	ND	ND	<0.3000	<0.0100
Chromium (TRC)	1	ND	ND	<0.0300	<0.0300
Copper (DIS)	13	0.0054	0.0108	0.0400	<0.0010
Copper (TRC)	1	ND	ND	<0.0020	<0.0020
Iron (DIS)	12	0.0805	0.1181	0.3600	<0.0050
Iron (TRC)	1	ND	ND	<0.0050	<0.0050
Lead (DIS)	13	ND	ND	0.0060	<0.0010
Lead (TRC)	1	ND	ND	<0.0020	<0.0020
Manganese (DIS)	13	0.0805	0.3156	1.2000	0.0130
Manganese (TRC)	1	0.3300	0.0000	0.3300	0.3300
Mercury (DIS)	13	ND	ND	0.0006	<0.0005
Mercury (TRC)	1	ND	ND	ND	ND
Selenium (DIS)	12	ND	ND	0.0140	<0.0010
Selenium (TRC)	1	ND	ND	<0.0040	<0.0040
Silver (DIS)	13	ND	ND	<0.0020	<0.0002
Silver (TRC)	1	ND	ND	<0.0002	<0.0002
Zinc (DIS)	13	0.0283	0.0396	0.1500	<0.0010
Zinc (TRC)	1	ND	ND	<0.0010	<0.0010

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise indicated. Statistics generated using monitoring wells MW-84-4, MW-84-6, MW-84-9, MW-84-11, MW-84-13, MW-84-22, and MW-84-23. Potential for spatial variability exists.

SU = Standard pH Units
TRC = Total Recoverable Metals Analysis
DIS = Dissolved Metals Analysis
ND = No Data
^{NC} = No average calculated if at least 50% of the data set is below detection.

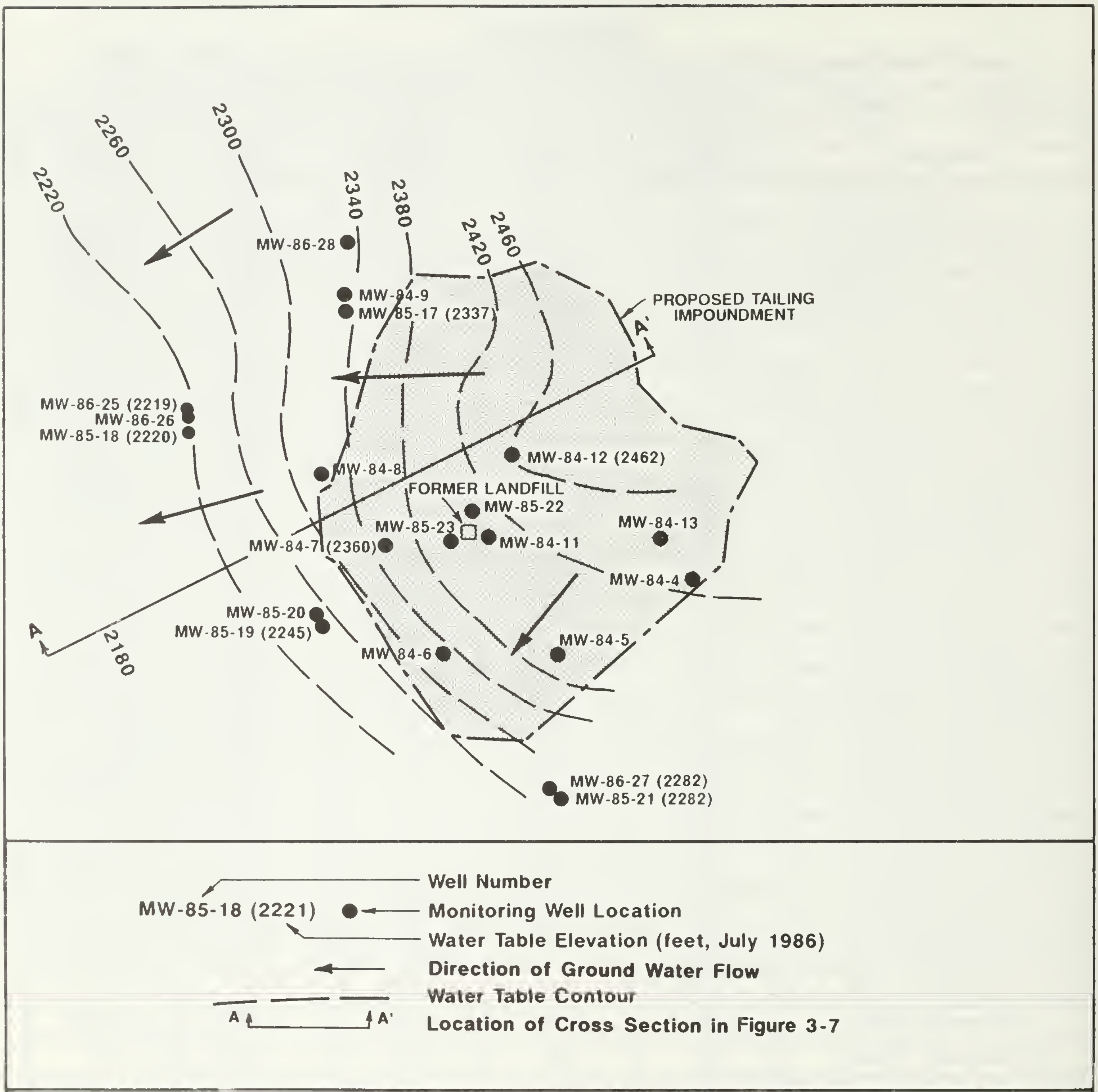
TABLE 3-11.
Ground Water Quality at Proposed Tailings Impoundment Site Sand and Gravel Wells

Parameter	Number of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	10	7.97	0.4547	8.8	7.4
Total Suspended Solids	10	16623.5000	23804.5157	55948.0000	45.0000
Total Hardness (as $CaCO_3$)	10	193.7000	96.8952	347.0000	81.0000
Total Alkalinity (as $CaCO_3$)	10	393.6000	555.3062	1960.0000	118.0000
Sulfate (SO_4)	6	4.1333	3.0722	10.0000	<3.0000
Ammonia (NH_3 as N)	9	ND	ND	1.2000	<0.0100
Total Kjeldahl Nitrogen (as N)	9	ND	ND	8.8000	<0.0100
Nitrate and Nitrite (as N)	9	0.4589	1.2535	3.8000	<0.0200
Orthophosphate (PO_4-P)	9	ND	ND	<0.1000	<0.0100
Total Phosphorus	6	3.2397	5.9453	15.0000	0.0380
Arsenic (DIS)	9	0.0023	0.0019	0.0050	<0.0010
Arsenic (TRC)	0	ND	ND	ND	ND
Cadmium (DIS)	9	0.0013	0.0012	0.0035	<0.0001
Cadmium (TRC)	0	ND	ND	ND	ND
Chromium (DIS)	12	ND	ND	<0.0330	<0.0100
Chromium (TRC)	0	ND	ND	ND	ND
Copper (DIS)	9	ND	ND	0.0050	<0.0010
Copper (TRC)	0	ND	ND	ND	ND
Iron (DIS)	9	0.0527	0.0792	0.2500	<0.0050
Iron (TRC)	0	ND	ND	ND	ND
Lead (DIS)	9	ND	ND	0.0020	<0.0010
Lead (TRC)	0	ND	ND	ND	ND
Manganese (DIS)	9	0.2424	0.3872	1.1000	<0.0100
Manganese (TRC)	0	ND	ND	ND	ND
Mercury (DIS)	9	ND	ND	<0.0005	<0.0002
Mercury (TRC)	0	ND	ND	ND	ND
Selenium (DIS)	6	ND	ND	0.0060	<0.0010
Selenium (TRC)	0	ND	ND	ND	ND
Silver (DIS)	9	ND	ND	<0.0002	<0.0002
Silver (TRC)	0	ND	ND	ND	ND
Zinc (DIS)	9	0.0459	0.0639	0.1500	<0.0010
Zinc (TRC)	0	ND	ND	ND	ND

Source: ASARCO, Incorporated 1987-1994.

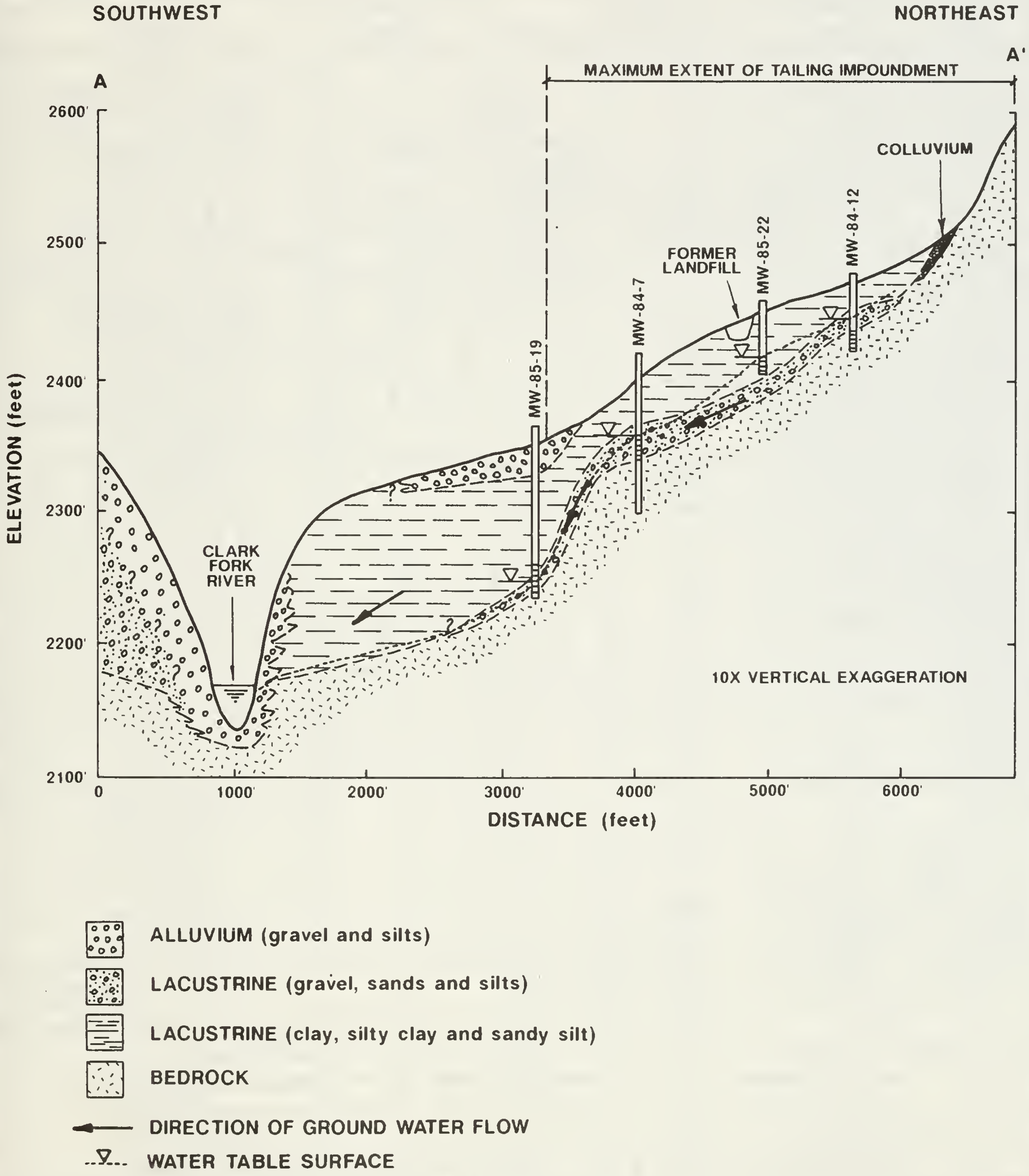
Notes: All units are in mg/L unless otherwise indicated. Statistics generated using monitoring wells MW-84-17, MW-84-18, and MW-84-19. Potential for spatial variability exists.

TRC = Total Recoverable Metals Analysis
SU = Standard pH Units
ND = No Data
DIS = Dissolved Metals Analysis
^{NC} = No average calculated if at least 50% of the data set is below detection.



Source: ASARCO, Incorporated 1987-1994.

FIGURE 3-6
Water Table - Tailings Impoundment Area
Rock Creek Project



NOTE: See Figure 3-6 for location of cross section.

FIGURE 3-7
Aquifer Cross-Section
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

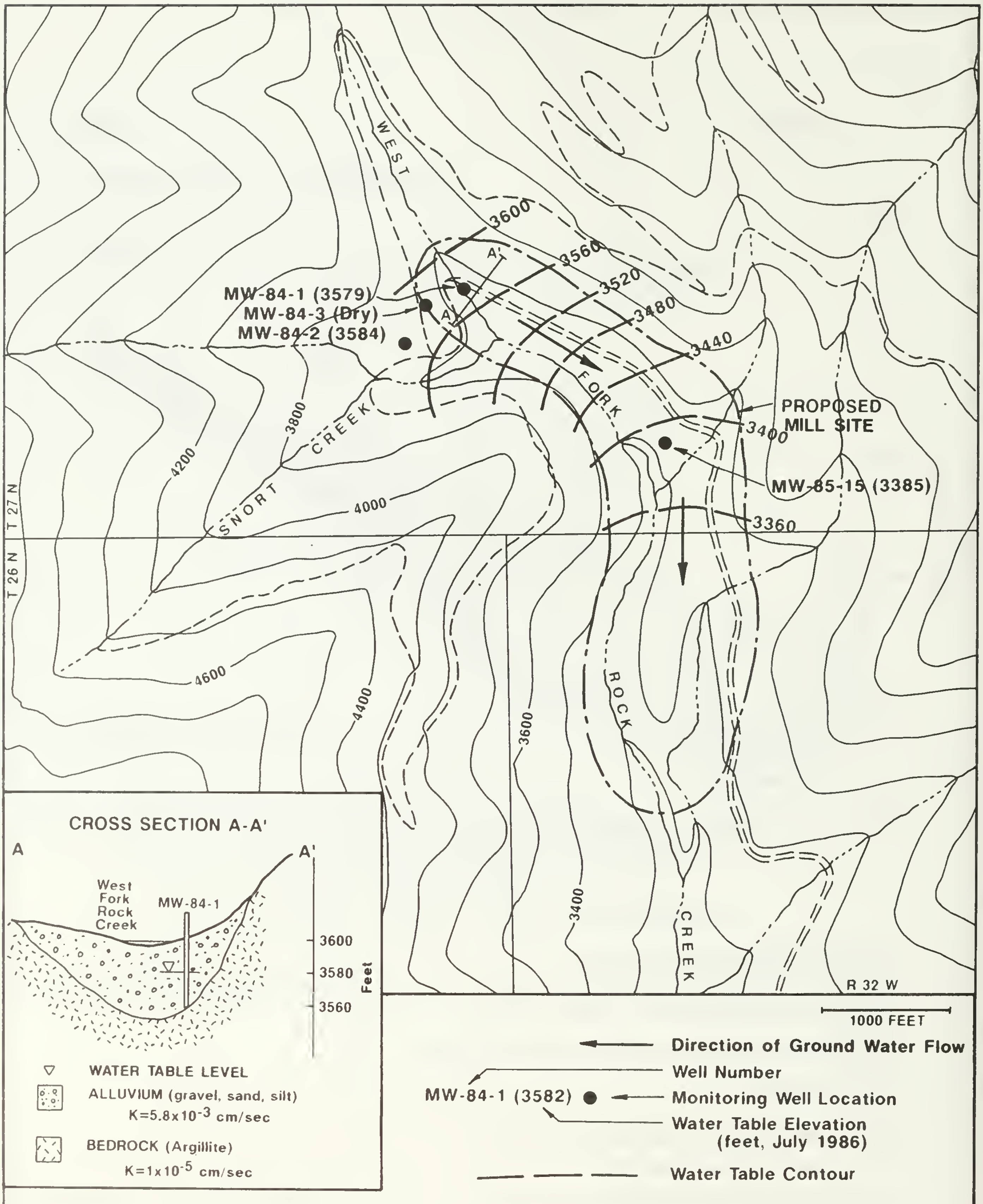


FIGURE 3-8
Water Table - Upper Mill Site
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

TABLE 3-12.
Ground Water Quality At Proposed Mill Site

Parameter	Number of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	6	7.05	0.4926	7.4	6.3
Total Hardness (as $CaCO_3$)	5	21.3333	9.2448	40.0000	16.0000
Total Alkalinity (as $CaCO_3$)	6	17.5000	4.5935	26.0000	13.0000
Sulfate (SO_4)	6	10.3667	16.5193	44.0000	3.0000
Ammonia (NH_3 as N)	5	0.2360	0.2671	0.[illegible]080	<0.1600
Total Kjeldahl Nitrogen (as N)	5	0.3600	0.3525	0.7700	0.0800
Nitrate and Nitrite (as N)	5	0.0410	0.0143	0.0680	<0.0500
Orthophosphate (PO_4-P)	6	ND	ND	<0.0500	<0.0100
Total Phosphorus	5	0.4650	0.5829	1.4000	<0.0500
Arsenic (DIS)	5	0.0019	0.0018	0.0080	<0.0010
Arsenic (TRC)	0	ND	ND	ND	ND
Cadmium (DIS)	5	0.0011	0.0013	0.0028	0.0001
Cadmium (TRC)	0	ND	ND	ND	ND
Chromium (DIS)	5	ND	ND	0.1500	<0.0300
Chromium (TRC)	0	ND	ND	ND	ND
Copper (DIS)	5	ND	ND	0.3500	<0.0010
Copper (TRC)	5	ND	ND	ND	ND
Iron (DIS)	5	15.8840	35.2829	79.0000	0.0800
Iron (TRC)	0	ND	ND	ND	ND
Lead (DIS)	5	ND	ND	0.0160	<0.0010
Lead (TRC)	0	ND	ND	ND	ND
Manganese (DIS)	6	0.8235	1.7546	4.4000	0.0320
Manganese (TRC)	0	ND	ND	ND	ND
Mercury (DIS)	5	ND	ND	0.0080	<0.0005
Mercury (TRC)	0	ND	ND	ND	ND
Selenium (DIS)	5	ND	ND	0.0080	<0.0010
Selenium (TRC)	0	ND	ND	ND	ND
Silver (DIS)	5	ND	ND	<0.0010	<0.0002
Silver (TRC)	0	ND	ND	ND	ND
Zinc (DIS)	5	0.9574	1.6576	3.9000	0.0200
Zinc (TRC)	0	ND	ND	ND	ND

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
TOT = Total Metals Analysis
TRC = Total Recoverable Metals Analysis
DIS = Dissolved Metals Analysis
ND = No Data
^{NC} = No average calculated if at least 50% of the data set is below detection.

TABLE 3-13.
Ground Water Quality at Alternate Mill Site

Parameter	Number Of Samples	Average^{NC}	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	2	7.05	1.2021	7.9	6.2
Total Suspended Solids	2	5.1000	0.1414	5.2000	5.0000
Total Hardness (as $CaCO_3$)	2	28.5000	0.7071	29.0000	28.0000
Total Alkalinity (as $CaCO_3$)	2	29.5000	2.1213	31.0000	28.0000
Sulfate (SO_4)	2	2.0000	0.0000	2.0000	2.0000
Ammonia (NH_3 as N)	2	ND	ND	<0.1600	<0.0500
Total Kjeldahl Nitrogen (as N)	2	0.0350	0.0354	0.0650	<0.0200
Nitrate and Nitrite (as N)	2	0.0355	0.0064	0.0400	0.0310
Orthophosphate (PO_4-P)	2	0.0065	0.0000	<0.0200	0.0030
Total Phosphorus	2	0.0400	0.0424	0.0700	0.0100
Arsenic (DIS)	2	0.0008	0.0003	0.0010	<0.0010
Arsenic (TRC)	2	ND	ND	ND	ND
Cadmium (DIS)	2	0.0006	0.0008	0.0012	<0.0001
Cadmium (TRC)	2	ND	ND	ND	ND
Chromium (DIS)	2	ND	ND	<0.0300	<0.0100
Chromium (TRC)	0	ND	ND	ND	ND
Copper (DIS)	2	ND	ND	<0.0010	<0.0010
Copper (TRC)	0	ND	ND	ND	ND
Iron (DIS)	2	0.0160	0.0028	0.0180	0.0100
Iron (TRC)	0	ND	ND	ND	ND
Lead (DIS)	2	ND	ND	<0.0010	<0.0010
Lead (TRC)	0	ND	ND	ND	ND
Manganese (DIS)	1	0.0050	0.0008	0.0050	0.0050
Manganese (TRC)	2	ND	ND	ND	ND
Mercury (DIS)	2	ND	ND	<0.0005	<0.0002
Mercury (TRC)	1	ND	ND	ND	ND
Selenium (DIS)	1	ND	ND	<0.0040	<0.0040
Selenium (TRC)	2	ND	ND	ND	ND
Silver (DIS)	2	ND	ND	<0.0002	<0.0002
Silver (TRC)	0	ND	ND	ND	ND
Zinc (DIS)	2	0.0070	0.0057	0.0110	0.0030
Zinc (TRC)	0	ND	ND	ND	ND

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise indicated.

SU = Standard pH Units

TRC = Total Recoverable Metals Analysis

TOT = Total Metals Analysis

ND = No Data

DIS = Dissolved Metals Analysis

^{NC} = No average calculated if at least 50% of the data set is below detection.

Ore Body

Because of the difficulty associated with installation of monitoring wells in a wilderness area, minimal information exists related to the hydrogeology of the ore deposit and overlying strata. Based on field observations of 120 exploration bore holes, ground water movement in bedrock underlying the CMW appears to be controlled by secondary permeability created by fractures, joints, and faults. Ground water in fractured bedrock probably accumulates from long-term recharge from precipitation and snowmelt, and is typically held in storage in bedrock void spaces. However, small quantities of ground water may also flow long distances through interconnecting fractures. Therefore, ground water in fractured bedrock may provide flow to deeper, regional ground water flow systems (assumed to be 500 feet below ground surface), or may discharge at the surface to springs and seeps.

Lakes in the vicinity of the ore body do not appear to be connected to the underlying ground water system. Exploration drill holes near Cliff and Copper lakes indicate the ground water table is several hundred feet below lake levels. Ground water encountered at less than 200 feet in depth may be evidence of perched water zones in fractured rock. Based on available data, Cliff and Copper lakes appear to be perched on bedrock, and receive recharge from surface runoff and near-surface fracture systems.

Well and Spring Inventory

Twenty-four perennial springs were identified in the study area during the baseline investigation. In addition, a number of ephemeral springs flow during the spring and early summer in response to snowmelt and recharge to local ground water. Two private wells with recorded water rights are located downgradient of the proposed project. All appropriations of water from wells and springs in the Rock Creek study area that are on file at Department of Natural Resources and Conservation are presented in **Table 3-14** and **Figure 3-9**.

Ground Water Quality

Ground water samples have been collected during the period of record from monitoring wells located in the vicinity of the proposed mill and tailings impoundment sites. Ground water quality in the unconsolidated valley fill deposits of West Fork of Rock Creek below the proposed mill site is of a soft, calcium bicarbonate-type, with low concentrations of total dissolved solids and metals. Ground water underlying the proposed impoundment area is generally a moderately hard to very hard, calcium-magnesium-bicarbonate type, with moderate-to-low concentrations of dissolved solids and low concentrations of metals.

Noxon Landfill

The former Noxon sanitary landfill is located within the proposed tailings impoundment area. This 2-acre landfill was operated between 1977 and 1983, and was permitted and periodically inspected by DHES. No hazardous wastes or chemicals have been identified in the Noxon landfill area (ASARCO, Incorporated 1987 - 1994). The landfill was closed and inspected by DHES, Solid and Hazardous Waste

TABLE 3-14.
Appropriations of Water From Wells and Springs in the Rock Creek Study Area

Water Right ID	Flow Rate	Point of Diversion				Source Name
		Qtr. Section	Section	Township	Range	
76N-W-001735-00	6.00 G	SESW	20	26N	32W	Clark Fork River
76N-W-001735-00	12.00 G	SESW	20	26N	32W	Noxon Reservoir
76N-W-001737-00	6.00 G	SESW	20	26N	32W	Noxon Reservoir
76N-C-008968-00	12.00 G	SESW	20	26N	32W	Well
76N-W-131978-00	30.00 G	NENWSE	20	26N	32W	Miller Gulch
76N-W-001610-00	20.00 G	NESWSW	20	26N	32W	Clark Fork River
76N-C-024084-00	20.00 G	NWNWSW	20	26N	32W	Well
76N-C-024085-00	25.00 G	NWNWSW	20	26N	32W	- -
76N-C-021186-00	15.00 G	SENWSW	20	26N	32W	Well
76N-C-042600-00	8.00 G	SENWSW	20	26N	32W	- -
76N-C-052693-00	5.00 G	SWSWNW	28	26N	32W	Well
76N-C-009296-00	25.00 G	NWSW	29	26N	32W	Well
76N-C-038604-00	18.00 G	SWNW	29	26N	32W	Well
76N-C-069756-00	16.00 G	NESESW	29	26N	32W	Well
76N-W-000352-00	.06 C	NWNENW	29	26N	32W	Clark Fork River
76N-W-000353-00	.04 C	NWNENW	29	26N	32W	Clark Fork River
76N-W-010087-00	11.22 G	NWNENW	29	26N	32W	Clark Fork River
76N-C-052738-00	25.00 G	NWNENW	29	26N	32W	Well
76N-C-066477-00	40.00 G	NWSWSE	29	26N	32W	Well
76N-W-124892-00	15.00 G	SESWNW	29	26N	32W	Clark Fork River
76N-C-010690-00	25.00 G	SWSWNW	29	26N	32W	Well
76N-C-019629-00	20.00 G	SWSWSW	29	26N	32W	Well
76N-C-076909-00	12.00 G	S2SWSE	29	26N	32W	Well
76N-C-054412-00	25.00 G	W2SENW	29	26N	32W	Well
76N-E-055021-00	6.00 G	NESW	32	26N	32W	- -
76N-C-028340-00	30.00 G	E2SWNE	32	26N	32W	Well
76N-C-010876-00	40.00 G	NENENE	32	26N	32W	Well
76N-C-037606-00	.13 G	NENWSW	32	26N	32W	- -
76N-C-037604-00	2.79 G	NESWSW	32	26N	32W	- -
76N-W-103199-00	- -	NESWSW	32	26N	32W	Clark Fork River
76N-W-103200-00	25.00 G	NESWSW	32	26N	32W	Clark Fork River
76N-C-051647-00	20.00 G	SESWNE	32	26N	32W	Well
76N-W-040630-00	5.00 G	SWNENW	32	26N	32W	Well
76N-W-133230-00	15.00 G	SWNENW	32	26N	32W	Well
76N-C-037605-00	2.79 G	SWNWSW	32	26N	32W	- -
76N-C-080234-00	30.00 G	SWNWSE	33	26N	32W	Well

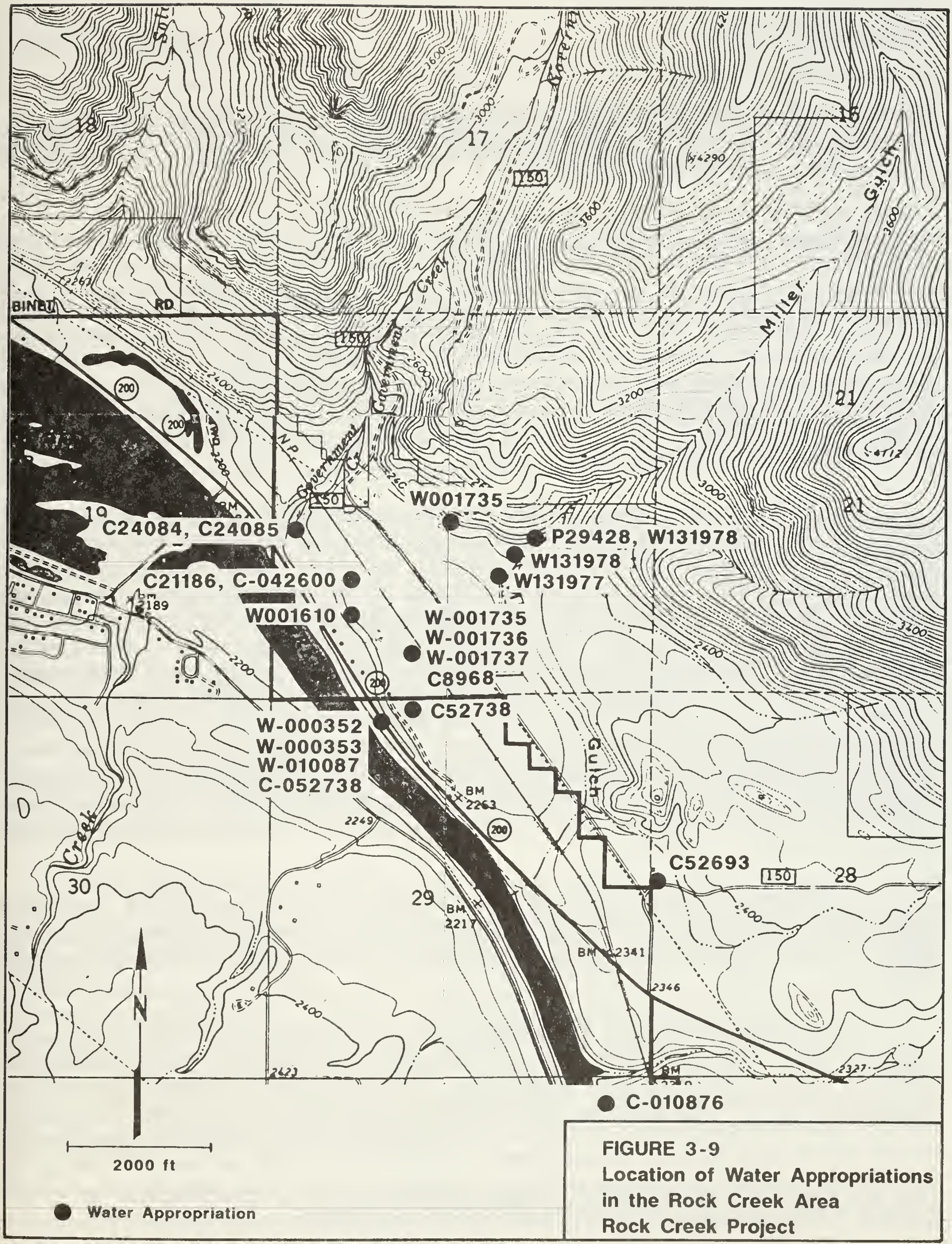


FIGURE 3-9
Location of Water Appropriations
in the Rock Creek Area
Rock Creek Project

Source: Department of Natural Resources and Conservation 1995.

Bureau, on June 21, 1983 in conformance with DHES standards. These standards require revegetation and an adequate cap (Rick Thompson, Department of Health and Environmental Sciences, personal communication, April 24, 1995).

WATERS OF THE U.S. AND WETLANDS

Waters of the U.S. and wetlands were identified and delineated for the baseline inventory (ASARCO, Incorporated 1993). In their natural condition, Waters of the U.S. and wetlands often provide many benefits, including food and habitat for fish and wildlife, flood protection, erosion control, water quality improvement, and opportunities for recreation (Adamus and Stockwell 1983). Delineation, avoidance, and mitigation measures are required (Section 404[b][1] of the Clean Water Act) for waters of the U.S. and wetlands in order to minimize potential impacts and to provide compensation for any unavoidable impacts through restoration or creation.

ASARCO prepared a wetlands inventory for the proposed Rock Creek project area (ASARCO 1993). The delineated inventory results are presented on 13 individual large-format map sheets attached to the Wetland Inventory and Mitigation Plan (ASARCO, Incorporated 1993). Wetlands and Waters of the U.S. were not mapped for the entire mine permit area, but only where mining-related impacts were proposed. The Corps of Engineers (COE) reviewed the wetland inventory results and conducted a site inspection on September 19-21, 1994. COE acknowledged that the wetland maps (13 sheets) were an accurate depiction of the jurisdictional wetlands and Waters of the U.S. within the permit boundary except for two minor errors (Corps of Engineers October 3, 1994). Due to the relatively small size of the delineated wetland areas compared to the large mine permit area, the mapped wetland areas are not visually readable on a standard-format figure. Mapping units and their approximate acreage included in the wetlands inventory are 1) wetlands - 10 acres; 2) non-wetland Waters of the U.S. - 52 acres; 3) wetland complex - 2 acres; and 4) riparian areas - 84 acres. Within the wetland complex and riparian areas are areas which may meet the technical criteria for wetlands but were not mapped except where mining-related impacts were proposed.

The affected acreages associated with mining alternatives are shown in **Table 2-4**. The acres of wetlands and Waters of the U.S. to be affected by individual mine-related facilities (such as the mill site, access road, topsoil stockpiles, and tailings impoundment) are shown for each mine alternative in **Table 4-24**.

The wetlands to be impacted by the proposed Rock Creek project can be placed in three main types, or classes of wetland habitats, based on the hierarchical system described by Cowardin et al. (1979). The three classes of wetlands are the Upper Perennial Riverine, the Forested Palustrine, and Emergent Palustrine Wetland systems. Wetlands located along the Rock Creek main channel and its tributaries have developed primarily on the low streamside terraces and are classified as Upper Perennial Riverine and Forested Palustrine wetland systems. Localized wet areas downstream of isolated springs and seeps also occur and are classified as Forested Palustrine wetlands. These wetlands have developed primarily in poorly and very poorly drained glaciolacustrine sediments.

Wetlands along the West Fork Rock Creek channel and tributaries are also associated with low terraces (often discontinuous, narrow, streamside terraces) and localized wet areas associated with springs and seeps. These wetlands are primarily classified as Forested Palustrine wetlands.

Wetlands along the ephemeral and intermittent drainages of Miller Gulch are associated with gentle rolling topography and have formed in the natural surface depressions that concentrate surface water runoff from adjacent areas and cause ponding. The low permeability of the near surface lacustrine clays and silts and the low hydraulic gradients in the area have created saturated soils and shallow standing water. Many areas of these broad shallow grassy swales have characteristics which meet the wetland criteria and are classified as Emergent Palustrine wetlands.

Technical guidelines (Environmental Laboratory 1987) for identifying and delineating wetlands are based on three diagnostic environmental characteristics unique to wetlands; wetland hydrology, hydric soils, and hydrophytic vegetation. In most cases, evidence of all three diagnostic characteristics must be found to make a wetland determination (Environmental Laboratory 1987).

Positive indicators of wetland hydrology were found primarily in low terraces adjacent to the main and overflow channels of perennial streams and their tributaries, within streamside riparian and floodplain zones, and downslope of seeps and springs. Many of these areas are not continuously inundated but are saturated at a sufficient frequency and duration during the growing season from snowmelt runoff, seasonal stream channel overflow, or as a result of rainfall. Some areas of the East and West forks of Rock Creek, and the lower portion of Rock Creek have developed broader stream bottoms which contain larger areas with wetland hydrology. Some areas of Miller Gulch have reduced hydraulic gradients with areas of nearly continuous inundation and ponding.

Hydric soils were identified in coarse to fine textured soils with a highly variable coarse fragment content (ASARCO, Incorporated 1993). Hydric soils were located along the banks, terraces, and channel bottoms of perennial, ephemeral, and intermittent streams, in seeps and spring areas, and in depressions formed naturally or by logging or road building activities.

The vegetation inventory of the Rock Creek study area conducted by Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994) was used to determine the vegetation types that potentially would have a dominance of hydrophytic (water loving) vegetative species. One vegetation type (Western red cedar/devils club) was determined to be dominated by hydrophytic species using the COE technical guidelines (Environmental Laboratory 1987). Devils club was found to be a good general indicator of a hydrophytic species-dominated forest site. Field verification involved sampling ten sites in June 1991 and an additional 12 sites in 1992. Of the 22 sites sampled, 18 were dominated by hydrophytic vegetation. Of the 18 sites, eight were dominated by tree species (Western red cedar, Western hemlock, and Black cottonwood), five were dominated by sedge species (Carex spp.), three were dominated by shrubs (Rocky Mountain maple, Willow spp., Alder spp., and *Douglas spiracea*), one was dominated by forbs, and one by bulrush (*Scirpus microcarpus*).

The wetlands identified and delineated by ASARCO within the proposed project area were recognized as providing several important functions and values (ASARCO, Incorporated 1993). Wetlands functions and values were stated as providing: 1) ground water recharge; 2) ground water discharge; 3) flood-flow alteration; 4) shoreline and streambank stabilization; 5) sediment and toxicant retention; 6) nutrient removal and transformation; 7) production export; 8) aquatic diversity and abundance; 9) wildlife diversity and abundance; and 10) recreation and uniqueness heritage. Functions and values of the project-area wetlands were assessed using best professional judgement based upon the available data and technical experience. **Table 3-15** contains a summary of the important ratings and rationales for the project area wetlands. A formal, standard, semi-quantitative evaluation assessment methodology, such as the habitat evaluation procedure (HEP) or Wetland Evaluation Technique (WET) was not used.

Aquatic and wildlife diversity and abundance were considered to be of moderate to high importance because the wetlands and adjacent major streams and tributaries provide the type and quality of habitat to fulfill these two functions. Although wetlands in the mine permit area do not sustain fish populations, the Waters of the U.S., including Rock Creek and East and West forks of Rock Creek, do support fish. Bull trout occur in all three streams and appear to be a permanent resident (ASARCO, Incorporated 1993). Wetlands in the mine permit area provide habitat for wildlife, including amphibians, reptiles, mammals, and birds. Wetlands and adjacent Waters of the U.S. provide habitat, seasonal forage, and breeding and resting areas. No bird or mammal species, that is thought to be dependent on wetlands, was recorded in the wetlands study area (ASARCO, Incorporated 1993). Grizzly bear, listed as a threatened and endangered species, also may use wetlands on a seasonal basis (see Aquatics/Fisheries, Biodiversity, and Threatened and Endangered Species).

These Rock Creek wetland sites may provide important aquatic habitat for fisheries; habitat for plant species of special concern (crested shield-fern, pointed broom sedge, black snake-root, and fringecup); and sensitive wildlife species habitat (such as the Harlequin duck and Coeur d'Alene Salamander). ASARCO has committed to performing a conservation assessment for crested sheild-fern (a designated Forest Service sensitive plant species) with the results of the survey available prior to issuing their ROD. Detailed information on aquatics/fisheries, plant species of special concern, and wildlife is included in chapters 3 and 4 of the draft EIS.

AQUATICS/FISHERIES

Rock Creek

The valley bottoms of the east and west forks and mainstem of Rock Creek are forested by the cedar/hemlock complex. Most large cedars along all three drainages were harvested in the late-1800s and early-1900s and have been replaced by a dense canopy of hemlock, younger cedars, and other seral species. Open overstories, particularly along lower Rock Creek, are dominated by alder, willow, cottonwood, dogwood, and other shrubs. Considerable stretches have no overhanging vegetation (Farmer, Farmer, and Heath *In* ASARCO, Incorporated 1987-1994; J.E. Huston, Department of Fish, Wildlife and Parks, personal communication, March 21, 1994).

Mainstem Rock Creek has an average gradient of 2 percent. Substrate in the lower reaches is comprised of large cobbles with few boulders, but the percentage of boulders increases upstream (Farmer,

TABLE 3-15.
Summary of Wetland Functions and Values for the Rock Creek Project Area

Wetland Function or Value	Importance Rating [1]	Rationale
Ground water discharge	low - regionally high - site specifically	Springs and seeps are common in the project area. Site-specific discharges create perennially wetland areas and augment small drainage channel flows.
Ground water recharge	low	Ground water recharge from ponds or wetlands with the water source from surface water is very limited in the project area.
Flood-flow alteration	low	Wetlands in project area are not extensive and do not have closed or constricted outlets.
Shoreline and streambank stabilization	moderate	Wetland plant communities assist in stabilizing streambanks, but are limited by seasonal high stream flows and velocities.
Sediment and toxicant retention	low - Rock Creek moderate - Miller Gulch	No sediments are known to contain toxicants. Rock Creek wetlands not well suited for retaining sediment. Miller Gulch wetlands retain sediment for longer periods of time.
Nutrient removal and transformation	low - Rock Creek moderate - Miller Gulch	No increased nutrients from urban or agricultural runoff. Rock Creek wetlands not characterized by long retention times. Miller Gulch wetlands have potential for longer retention periods.
Aquatic diversity and abundance	moderate - regionally high - site specifically	Wetlands support the diversity and abundance of fish and invertebrates. Rock Creek and its East and West forks all contain fish. Bull trout occur in all three streams, although steep gradients and low flows may limit trout distribution.
Wildlife diversity and abundance	moderate - regionally high - site specifically	Wetlands are known to provide habitat values important to the diversity and abundance of wildlife, including breeding, migration, and wintering. Because the individual wetlands within the project area are small, the wildlife species are mobile, and the availability of forage in other habitats, most wildlife species were not dependent on wetlands for forage, cover, or other uses.
Recreation and uniqueness heritage	low	Wetlands in the project area do not provide important recreational functions or values, nor do they represent ecological or other conditions/resources unique for the area or region.

[1] Importance rating was based on best professional judgement from available data and technical experience (ASARCO, Incorporated 1993).

Farmer, and Heath *In* ASARCO, Incorporated 1987-1994). Substrate is relatively unstable and there is considerable bedload movement. Spawning habitat is limited to isolated pockets of gravel behind stable debris or boulders above the confluence of Engle Creek. Below Engle Creek, spawning habitat was found behind stable debris and boulders as well as some main-channel depositional areas. A major source of these gravels and fine sediments is a large eroding bank located about 0.2 miles up Engle Creek (Smith 1994).

Samples of spawning areas were taken in 1994 in the area just downstream of the confluence of Engle Creek. This sampling indicated that an average of 43.1 percent of the substrate in the spawning areas is composed of materials less than 0.25 inch. (The twelve samples ranged from 25.0 to 56.9 percent smaller than 0.25 inch) (Smith 1994). Weaver and Fraley (1991 and 1993) found that the higher the percent of the spawning substrate less than 0.25 inch in diameter, the lower the survival-to-emergence success of bull trout and westslope cutthroat trout. Therefore, survival to emergence in Rock Creek will be about 15 percent for westslope cutthroat and 18 percent for bull trout (Smith 1994).

East Fork of Rock Creek begins at Rock Lake. There is a low-gradient section in Rock Creek Meadows, below Rock Lake (Farmer, Farmer, and Heath *In* ASARCO, Incorporated 1987-1994). Below Rock Creek Meadows, it is a steep-gradient (average 10.4 percent), perennial stream with a partially closed coniferous overstory and overhanging deciduous understory.

The upper reaches of the East Fork contain considerable amounts of stable, large woody debris. The substrate consists primarily of large cobbles and boulders with relatively little movement of the stream substrate. Streambanks are stable with some channel braiding. Spawning habitat is isolated to pockets of gravel behind debris or boulders (Smith 1994).

West Fork of Rock Creek's gradient is highly variable, but averages 7.3 percent. It has a generally closed coniferous overstory and shrub understory for its entire length (Farmer, Farmer, and Heath *In* ASARCO, Incorporated 1987-1994). Streambanks are stable with some channel braiding. The entire lower reach (0.4 mile) of the West Fork is intermittent as is 0.4 mile of the middle reach (Smith 1994).

The West Fork of Rock Creek contains very high amounts of stable large woody debris. A potential fish passage barrier consisting of large, woody debris mixed with gravel exists 0.75 mile upstream from the mouth of the West Fork (R.W. Smith, Washington Water Power Company, personal communication, March 3, 1994). Substrate primarily consists of small cobble and gravel with relatively little bedload movement. Spawning habitat is present in the form of pockets of gravel behind and above stable debris or boulders and in the main channel depositional areas. The average percent of substrate less than 0.25 inches ranged from 24.2 to 27.4 percent at the two sample sites. (The 24 samples collected ranged from 19.4 to 53.7 percent smaller than 0.25 inch.) Survival to emergence in West Fork of Rock Creek is about 35 to 40 percent for westslope cutthroat and 40 to 44 percent for bull trout (Smith 1994).

Aquatic Plants

Baseline data for periphyton was collected at nine stations in the Rock Creek drainage (**Figure 3-10**) for 1 year (1985) during April, August, and October. Vegetation samples from Rock Creek reflect its clean, soft water (Hydrometrics, Inc. *In* ASARCO, Incorporated 1987-1994). They also indicate a cold-water stream with high plant diversity and low productivity; that is, there are many species of plants but few numbers of each species. This is probably typical of heavily forested streams in northwest Montana but is in marked contrast with the nearby Clark Fork River. Most flora samples reflect the highly variable flow conditions in Rock Creek.

Rock Creek is characterized by a highly diverse diatom community (121 diatom taxa were identified) and a few species of non-diatom, soft-bodied algae. Large, complex water plants are restricted to the Rock Creek Meadows wetland and a few permanent springs scattered across the watershed.

Some green, blue-green, and red algae were identified. The highest diversity of plants occurs in the main channel of Rock Creek downstream of the East and West forks confluence. Baseline samples included several unusual planktonic algae normally found in lakes and ponds. These planktonic species probably drifted into Rock Creek from Rock Creek Meadows and the trout ponds in Engle Creek.

Aquatic Invertebrates

Baseline data were collected at nine stations in the Rock Creek drainage (see **Figure 3-10**) for 4 years (1985-1988) during April, August, and October (ASARCO, Incorporated 1987-1994). However, not every station was sampled every year due to inaccessibility, excessive streamflow, no streamflow, or other reasons. The only stations that have a complete data set (samples taken in every season for all 4 years) are RC-2 and WRC-4; the incomplete data sets for the remaining stations are shown on **Table 3-16**.

TABLE 3-16.
Stations in the Rock Creek Drainage That Were Not Consistently Sampled
(Numbers are the years of variable conditions.)

	RC-1	RC-3	ERC-1	WRC-1	WRC-2	WRC-2a
April	88[2]	–	85[3]	88[1]	–	85[4],87[5], 88[5]
August	88[2]	–	–	86[1],87[1],88[1]	–	–
October	87[1],88[1]	87[1]	–	85[1],86[1],87[1]88[1]	86[1],87[1]88[1]	–

[1] = dry
[2] = too deep
[3] = too fast
[4] = site not established yet
[5] = not accessible due to deep snow
Source: ASARCO, Incorporated 1987-1994.
Note: Not consistently sampled during the baseline because of a dry streambed.

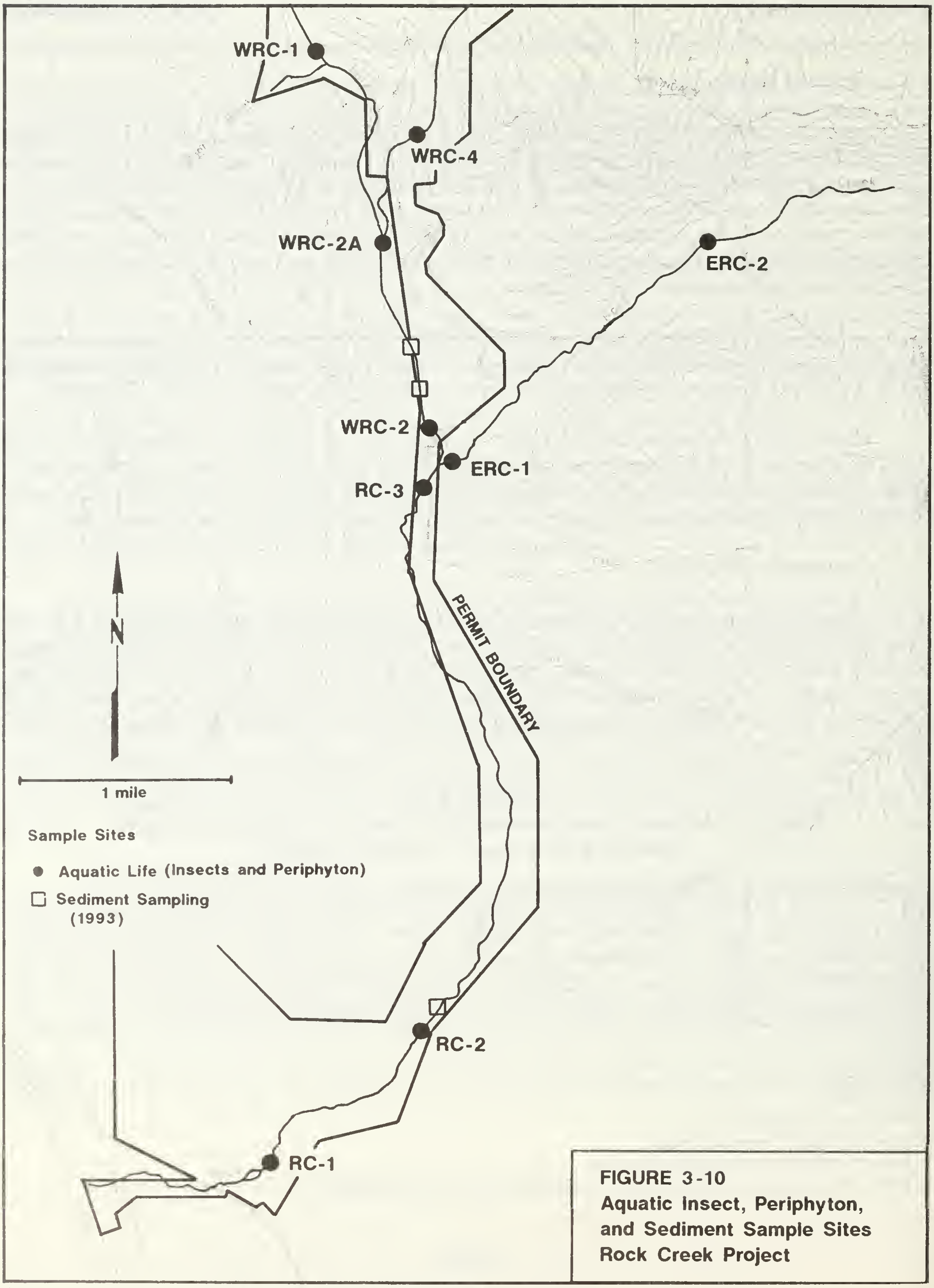


FIGURE 3-10
Aquatic Insect, Periphyton, and Sediment Sample Sites
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994 and Smith 1994.

Summaries of the quantitative macroinvertebrate baseline data appear in **figures 3-11, 3-12, and 3-13**. Densities of macroinvertebrates were highly variable between sites, seasons, and years. In general, April samples contained fewer macroinvertebrates than samples taken in August or October, although this was not true at every site. The sample site on the upper West Fork of Rock Creek (WRC-1) shows higher average numbers of macroinvertebrates in April because that site was usually dry in August and October (ASARCO, Incorporated 1987-1994).

Overall, the sampling site on a tributary of West Fork of Rock Creek (WRC-4) had the highest numbers of aquatic macroinvertebrates, with mean numbers exceeding 80 macroinvertebrates/ft^2 in 50 percent of the samples. This tributary stream flows through ASARCO's proposed mill site. Although the April information is incomplete, it appears that WRC-2A had the second highest macroinvertebrate density. Sites WRC-1 and RC-1 tended to have the lowest density of macroinvertebrates, reflecting the intermittent nature of the stream at those locations.

Overall the Rock Creek drainage supports good diversity of invertebrates but relatively low total numbers, similar to other high quality streams in western Montana. Approximately 75 taxa were identified during studies conducted from 1985-1988. The most common types of macroinvertebrates found in Rock Creek are clean-water forms such as mayflies, stoneflies, and caddisflies. Of the total macroinvertebrates sampled, mayflies (Ephemeroptera) represented between 30 and 73 percent, stoneflies (Plecoptera) contributed between 9 and 38 percent, and caddisflies (Trichoptera) contributed between 2 and 13 percent (see **Figure 3-14**). Other (which includes true flies (Diptera), beetles (Coleoptera), and other invertebrates) represented between 5 and 29 percent of the total sample (ASARCO, Incorporated 1987-1994).

The Shannon-Weaver diversity index is generally less than three for samples taken in the Rock Creek drainage. A number this low would usually indicate environmental stress. However, the reason for the low diversity index is the relatively low level of productivity in Rock Creek and the low number of organisms/sample (ASARCO, Incorporated 1987-1994).

The most widespread organism found in Rock Creek is the mayfly *Cinygmula sp.* Other common taxa included the mayflies *Rhithrogena sp.*, *Eperus sp.*, *Baetis sp.* and *Drunella doddsi*, and the stoneflies *Suwallia sp.*, *Megarcys sp.*, and *Zapada columbiana*. All of these species are indicative of clean waters, except for *Baetis sp.*, which can tolerate a wide range of conditions. Flow regime is the factor that has the most influence on the macroinvertebrate communities in the Rock Creek Drainage. Perennial sample sites tended to support larger densities than intermittent or frequently dry sites (ASARCO, Incorporated 1987-1994).

Fish

Four species of fish have been found in the Rock Creek drainage: westslope cutthroat trout (*Onchorhynchus clarki*), bull trout (*Salvelinus confluentus*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Onchorhynchus mykiss*). Cutthroat trout and bull trout are the dominant species. Analysis of the genetics of a sample of 21 fish taken from the East Fork of Rock Creek showed a pure westslope

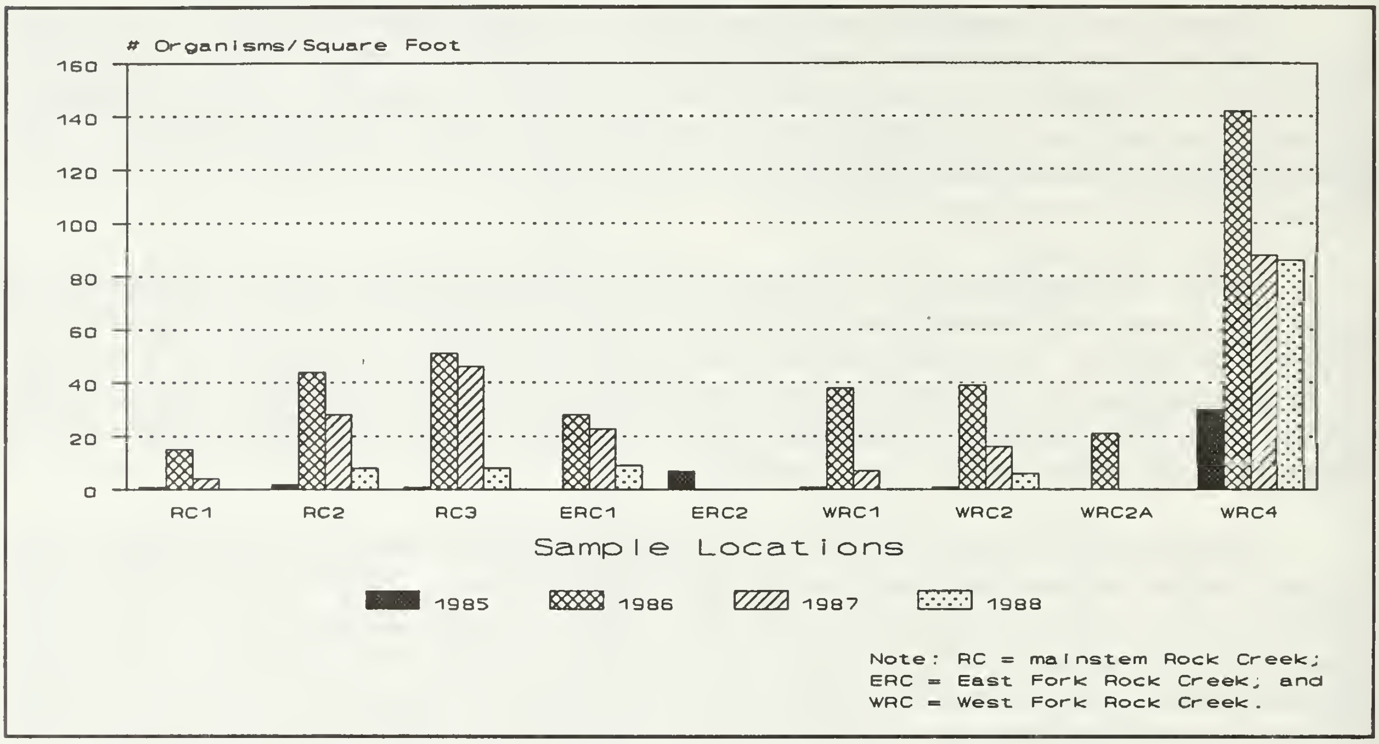


Figure 3-11. Rock Creek Aquatic Macroinvertebrates/ft² - April 1985 through April 1988.

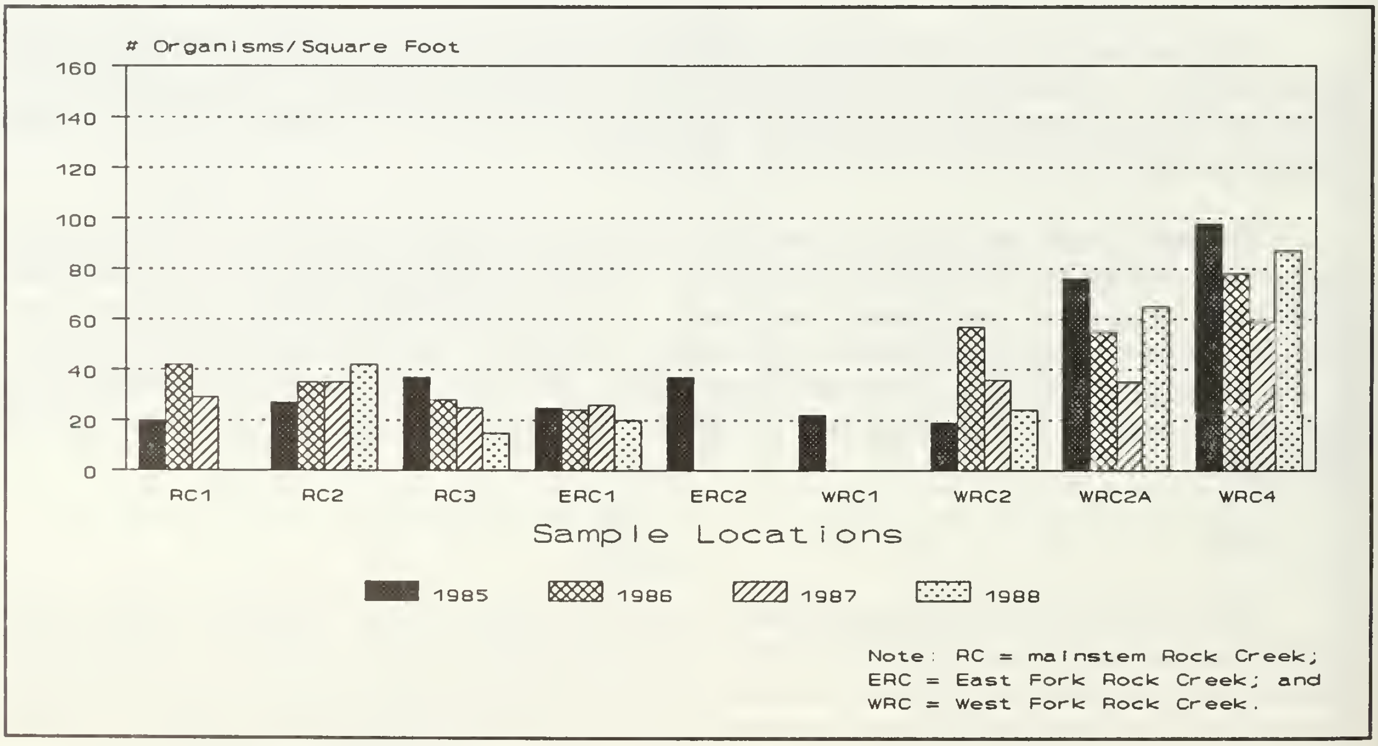


Figure 3-12. Rock Creek Aquatic Macroinvertebrates/ft² - August 1985 through August 1988.

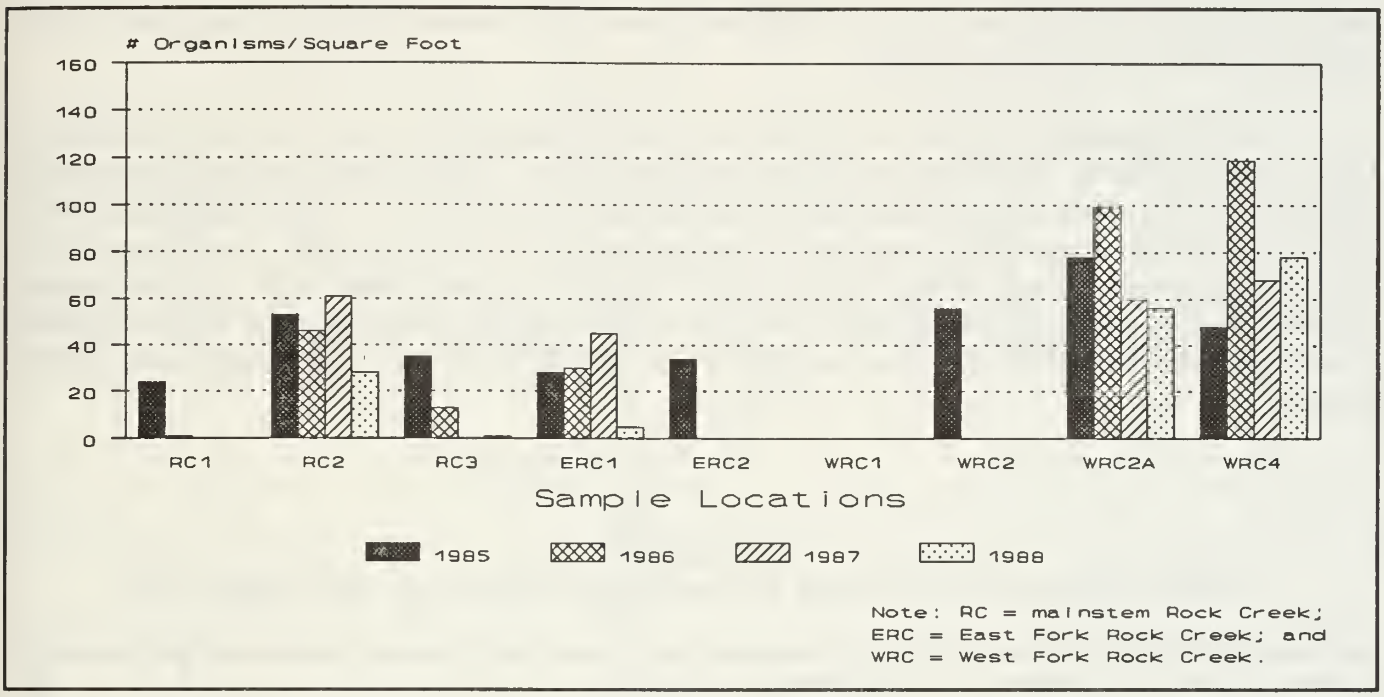


Figure 3-13. **Rock Creek Macroinvertebrates/ft² - October 1985 through October 1988.**

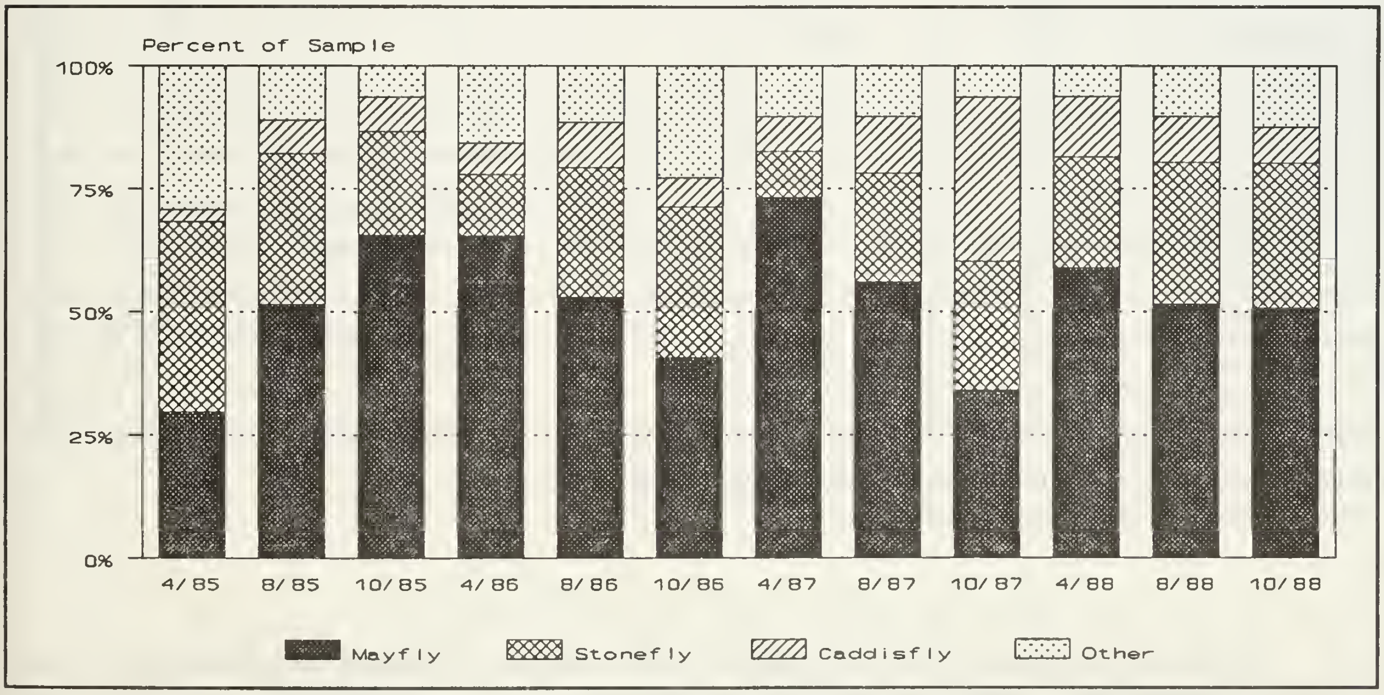


Figure 3-14. **Major Orders of Aquatic Macroinvertbrates Sampled in the Rock Creek Drainage, 1985-1988.**

cutthroat population (Hightower 1988). Westslope cutthroat and rainbow trout are spring-spawning fish. Bull and brook trout spawn in the fall.

Only one rainbow trout has been found in 3 years of sampling-- it was in the upper mainstem of Rock Creek (below the confluence of the East and West forks). Brook trout were only found in the mainstem of Rock Creek. Population data are summarized in **Table 3-17**. A likely limiting factor for fish in this drainage is the three intermittent stream segments, RC-1, RC-4, and WF-1 (see **Figure 3-15**). These three segments have the lowest density of fish in the drainage (see **Table 3-17**). The two perennial segments support fish that are from 1 to 4 years old, whereas the intermittent segments support primarily 1 and 2 year old fish. RC-2 (a perennial segment) has also been cited as having significant spawning habitat.

TABLE 3-17.
Density of Fish and Fish Species Composition in Rock Creek, 1985, 1986, 1993

Section & Year Sampled	Density Fish/100ft^2	% Westslope cutthroat	% bull trout	% brook trout	% rainbow trout
RC-1 1986	.85	70	9	40	0
RC-2 1993	1.81	35	2	63	0
RC-2 1986	1.8	55	5	40	0
RC-2 1985	3.03	65	1	34	0
RC-4 1986	.33	70	23	0	7
RC-4 1985	.37	18	18	0	0
WF-1 1993	.29	24	70	0	0
WF-1 1986	.29	35	70	0	0
WF-1 1985	.42	18	82	0	0
EF-1 1993	2.28	81	19	0	0
EF-1 1988	1.3	69	31	0	0
EF-1 1986	3.3	70	30	0	0
EF-1 1985	1.2	75	25	0	0

Source: Barnard and Vashro 1986; Hightower and Vashro 1987; Smith 1994.
Note: All sampling conducted in the summer season.

The West Fork of Rock Creek was sampled in the (upstream) perennial sections for the first time in 1993 (see **Table 3-18**). These were the first fish sample data collected in this portion of the West Fork to date. Fish densities are far higher in this portion of the stream than in the lower, intermittent reach (see **Table 3-17**).

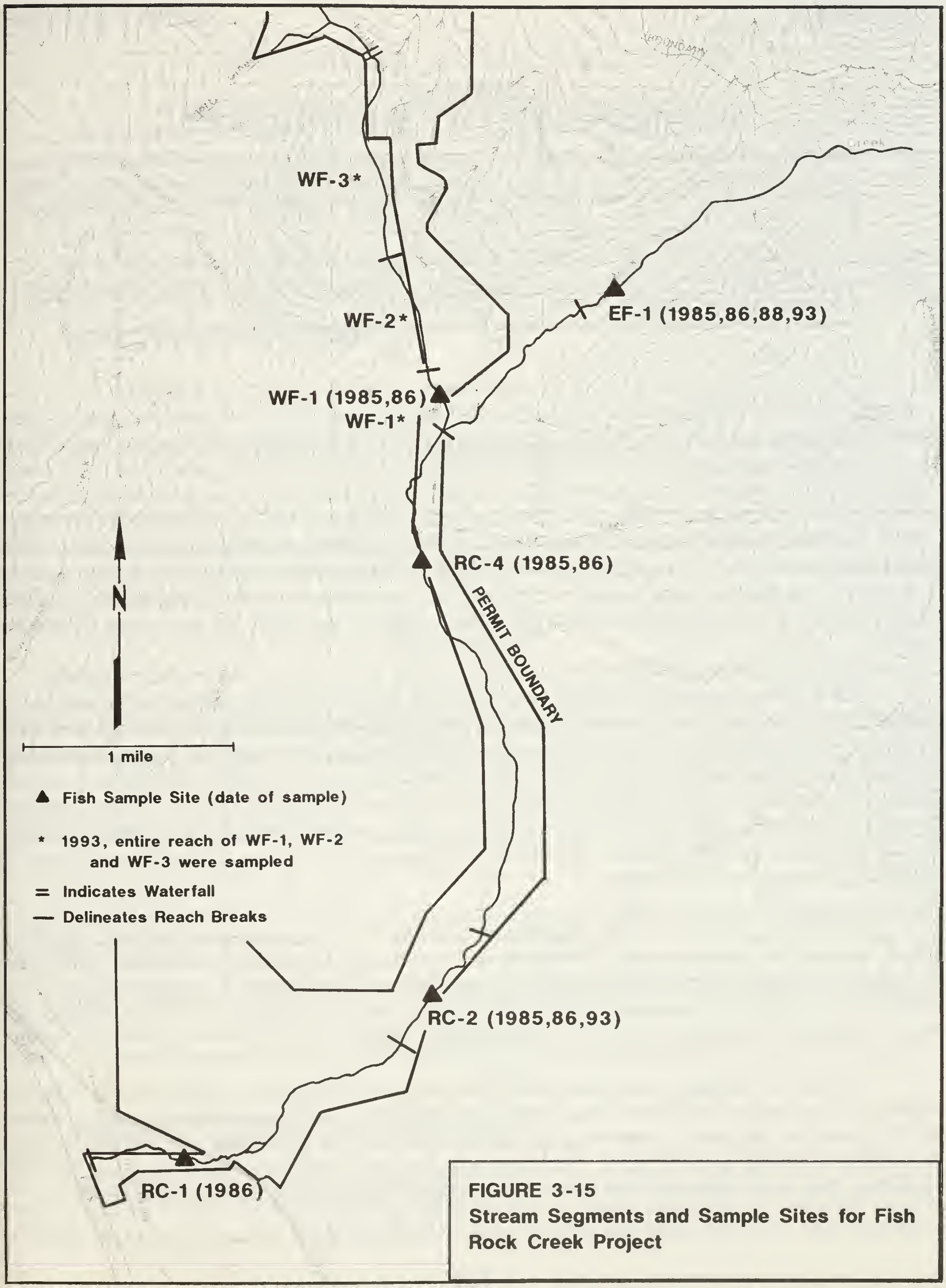


FIGURE 3-15
Stream Segments and Sample Sites for Fish
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994 and Smith 1994.

TABLE 3-18.
Fish Densities in the West Fork of Rock Creek in Fall 1993

	Number per 100 ft^2		
Reach: W Fk Rock Ck.	Cutthroat	Bull Trout	Total
WF-1 (mouth to RM .37)[1]	0.93 (43%)	1.21 (57%)	2.14
WF-2 (RM .37 to RM .50)	0.74 (40%)	1.11 (60%)	1.85
WF-3 (RM .50 to RM .74)	0.84 (43%)	1.11 (57%)	1.95

Source: Smith 1994.

Note: RM = river mile

[1] In 1993 the entire reach of WF-1 was sampled, in addition to a small sample site. Data from the sample site are reported in **Table 3-17**.

A 1988 sample of fish from Rock Creek Meadows, a 59-acre flooded mountain meadow on the East Fork of Rock Creek, was analyzed by the University of Montana Wild Trout and Salmon Genetics Laboratory. Researchers found westslope cutthroat trout; westslope cutthroat crossed with Yellowstone cutthroat trout; and westslope cutthroat, Yellowstone cutthroat, and rainbow trout crosses (Hightower 1988).

Populations of westslope cutthroat trout and brook trout appear to be permanent (nonmigratory) residents of Rock Creek. Rock Creek may support both resident and migratory bull trout. In West Fork of Rock Creek, 1-to-3-year-old bull trout have been found upstream of the potential fish passage barrier. This barrier has been estimated to be in place for at least 2 to 3 years, potentially indicating a resident, isolated population of bull trout in upper West Fork of Rock Creek (Smith, pers. comm., March 3, 1993). A waterfall located about 1.5 miles upstream of the confluence with the East Fork is a barrier to fish movement and the upstream limit of fish distribution in this drainage (Barnard and Vashro *In* ASARCO, Incorporated 1987-1994).

In addition, there is evidence of bull trout migration from Cabinet Gorge Reservoir into Rock Creek, presumably for spawning. Hightower and Vashro *In* ASARCO, Incorporated 1987-1994) collected a 27-inch bull trout that appeared to be from Cabinet Gorge Reservoir at section RC-2. Large bull trout have also been documented in Rock Creek (Joe Huston, Department of Fish, Wildlife and Parks, personal communication, March 9, 1995 and May 1982).

Location of migratory bull trout spawning has not been documented. Hightower and Vashro *In* ASARCO, Incorporated 1987-1994, commented on the presence of adequate spawning habitat in section RC-2 (a perennial segment). However, later studies by Smith 1994 found high levels of fine sediment in potential spawning areas of RC-2. Although migratory and resident bull trout may use RC-2 for spawning, they likely experience low survival-to-emergence as a result of high sediment levels.

Several fish population trends are apparent. In RC-2, the 1993 estimate of 1.81 fish\100 feet^2 is comparable to previous estimates. However, there appears to be a shift in species composition towards relatively more brook trout and fewer cutthroat trout. This may be explained by the fact that a side channel was sampled in 1993 that had not been sampled previously. This side channel contained brook trout almost exclusively (Smith, pers. comm., March 3, 1994).

Slow fish growth in Rock Creek is typical for a low-productivity mountain stream. In samples taken in 1987, cutthroat averaged 5.6 inches long and bull trout averaged 6.3 inches (Hightower 1988).

Metals Concentration in Tissues

The average concentration of metals in fish tissues in Rock Creek and the East Fork of Rock Creek is listed in **Table 3-19**. The mean value of 3.0 parts per million (ppm) copper is comparable to values found in Lake and Stanley creeks (Montana Department of State Lands and Kootenai National Forest 1978) and is less than half that found in Libby Creek (U.S. Forest Service et al. 1992). The mean zinc values (75-82 ppm) are substantially higher than zinc values found in other nearby streams--30.1 ppm in hybrid redband trout in Libby Creek (U.S. Forest Service et al. 1992), and 23.2 to 44.0 ppm from Stanley and Lake creeks (Montana Department of State Lands and Kootenai National Forest 1978). Mercury values in Rock Creek and the East Fork of Rock Creek are comparable to mercury values found in Libby Creek (0.19 ppm).

TABLE 3-19.
Metals Concentration of Westslope Cutthroat Trout Collected From Rock Creek, 1985

	Rock Creek			East Fork		
	Copper	Zinc	Mercury	Copper	Zinc	Mercury
mean concentration (ppm)	3.0	82	0.12	3.0	75	0.13
standard deviation	0.5	22.9	0.03	3.0	15.4	0.05
number of samples	25	26	11	25	20	11
mean fish length	7.9	7.9	8.7	8.4	8.4	9.0
fish length range	5.8-10.9	5.8-10.9	6.8-9.8	7.2-10.1	7.2-10.1	8.2-10.1

Source: Barnard and Vashro *In* ASARCO, Incorporated 1987-1994.
Notes: Fish length is in inches. Gill tissue was analyzed for copper and zinc; muscle tissue was analyzed for mercury.

Threatened, Endangered, and Sensitive Species

Both dominant fish species in this drainage (bull trout and westslope cutthroat trout) are listed as sensitive species by the U.S. Forest Service and as species of special concern by the Montana Chapter of American Fisheries Society and Department of Fish, Wildlife and Parks (DFWP). Bull trout have been determined to be warranted for listing under the Endangered Species Act, however, they are not listed due to their low priority for protection with the USFWS.

Clark Fork River/Cabinet Gorge Reservoir

Cabinet Gorge Reservoir is used as a regulating reservoir for Noxon Rapids with frequent daily water level fluctuations of 2 to 4 feet. Discharge from Noxon Dam varies daily and seasonally, depending on the demand for electrical power. When discharge rates are high, Cabinet Gorge in the vicinity of Rock Creek resembles a river rather than a reservoir.

Because of rapid water exchange rates, Cabinet Gorge Reservoir is almost always the same temperature on the surface as on the bottom (Huston, pers. comm., March 21, 1994). Therefore, there is rarely any refuge for cold-water fish in deep portions of the reservoir. It also means that dissolved oxygen levels in the reservoir are usually adequate for fish, even at depth. Maximum temperature rarely exceeds 72 degrees F, except in some backwater shallows. The operational plan for Noxon Rapids Reservoir requires that drawdowns be limited to 10 feet during normal circumstances. This plan has been in effect since 1986. These drawdown limits on Noxon Rapids have resulted in lower drawdown in Cabinet Gorge Reservoir as well.

Aquatic Plants

Five groups of algae grow in the lower Clark Fork River system: 1) green algae, 2) golden-brown algae, 3) diatoms, 4) red algae, and 5) blue-green algae. Of the nondiatom algae, the most diverse and abundant group was the green algae (Chlorophyta), followed by the blue-green algae (Cyanophyta).

Diatoms are the most abundant group in the Clark Fork River just below Noxon Reservoir, except in the summer of 1984 when the green filamentous alga, Spirogyra, ranked first. Up to 57 species of diatoms can be found just below Noxon Dam. This stretch of river yields diatom diversity indices (a measure that expresses the number of species and their abundance) ranging from 4.0 to 4.9 (Montana Department of Health and Environmental Sciences 1985). These values fall within the range of 3 to 5 found for other unpolluted Montana streams (Bahls 1984). The unpolluted nature of the river with regard to biological oxygen demand is further indicated by the predominance of pollution-sensitive diatom species (Priscu 1989).

Aquatic Invertebrates

Because of rapid exchange rates, neither Noxon Rapids nor Cabinet Gorge reservoirs produce much zooplankton. It appears that the reduction of drawdowns that has occurred since 1986 has increased benthic invertebrate diversity and numbers. In 1987, 13 groups (families or orders) of invertebrates were found in Cabinet Gorge (Huston 1988).

Fish

Sixteen fish species are found in Cabinet Gorge Reservoir. The relative abundance of these fish is reported in **Table 3-20**, which shows fish captured during 1960 and 1985 gill-netting. (Although no northern pike were collected during gill netting, they have been known to be in the reservoir since 1974.) Stations C-1 and C-2 had the lowest catch per night of the four stations (8.4 fish per net night). These stations are more river-like than the other two stations. Northern squawfish, peamouth, and mountain whitefish were the most abundant fish species at station C-1. Game fish species collected at C-1 included mountain and lake whitefish, and brown and bull trout.

TABLE 3-20.
Average Monthly Catch Per Net Night for Fish Captured in Gill Nets in Four Locations on Cabinet Gorge Reservoir, July - November 1985

Species	C-1	C-2	C-3	C-4	Average 1985	Average 1960
Mountain whitefish	1.1	3.9	1.8	0.2	0.6	5.9
Lake whitefish	0.7	0.2	1.1	–	0.0	0.3
Brown trout	0.6	0.9	1.1	–	0.6	0.0
Rainbow trout	–	0.6	0.6	–	0.1	3.0
Westslope cutthroat trout	–	0.9	–	–	0.1	0.0
Bull trout	0.1	0.3	–	–	0.1	0.8
Brook trout	–	–	0.1	–	0.1	0.0
Yellow perch	1.0	0.2	5.3	0.7	0.6	5.9
Northern squawfish	1.8	0.7	0.6	1.8	2.7	5.9
Peamouth	1.8	0.6	1.1	10.4	0.1	3.0
Largescale sucker	0.2	–	1.3	–	0.6	0.3
Redside shiner	1.0	1.3	0.3	0.3	1.3	0.0
Pumpkinseed	–	0.2	1.0	–	0.3	0.0
Longnose sucker	0.1	–	–	–	0.0	1.4
Largemouth bass	–	–	–	–	–	0.1
TOTAL	8.4	8.4	19.8	16.3	13.2	27.6

Source: Barnard and Vashro *In* ASARCO, Incorporated 1987-1994; Huston 1985.

Notes: Station CG-1 was a bottom set located upstream from the mouth of Rock Creek. CG-2 was a surface set located in the mouth of Rock Creek. Station CG-3 was a bottom set 0.62 miles downstream from the mouth of Rock Creek. Station CG-4 was a surface set 0.69 miles downstream from the mouth of Rock Creek.

At station C-2 mountain whitefish was by far the most abundant fish, mostly collected during July. Whitefish may have been in this area then because of cooler water flowing from Rock Creek.

Station C-3 had the highest catch per net night of any of the stations. Northern squawfish were the most abundant fish, followed by yellow perch, mountain whitefish, peamouth, and largescale suckers. While station C-4 had almost as many fish per net night as station C-3 (16.3), only five species were collected at this site.

Gill net data from 1960 are presented in **Table 3-20** in order to illustrate changes in fish species composition over time. Rainbow trout have not been abundant in Cabinet Gorge since the 1960 survey. Bull trout numbers have also declined since the reservoir was built in 1953.

Metals Concentration in Tissues

A summary of metals levels found in fish in Cabinet Gorge Reservoir is in **Table 3-21**. The values for copper (3.0 ppm), zinc (73 ppm), and mercury (0.13 ppm) are comparable to those found in fish in Rock Creek and East Fork Rock Creek (see **Table 3-19**).

TABLE 3-21.
Metals Concentration in Mountain Whitefish
Collected from Cabinet Gorge Reservoir, 1985

	Copper	Zinc	Mercury
mean ppm	3.0	73	0.13
range (ppm)	2.0-6.0	58-91	0.08-0.22
stand. deviation	1.1	10.0	0.05
number tested	25	22	11
Mean Fish Length (in)	12	12	12
Fish Length range (in)	9.6 -13.7	9.6 -13.7	9.6 -13.7

Source: Barnard and Vashro *In* ASARCO, Incorporated 1987-1994.
Notes: Gill tissue was analyzed for copper and zinc; muscle tissue was analyzed for mercury.

Threatened, Endangered, and Sensitive Species

Prior to construction of Cabinet Gorge Dam, several species of fish, reportedly including bull trout and westslope cutthroat trout, migrated from Lake Pend Oreille into the upper Clark Fork River drainage. Cabinet Gorge Dam blocked all access by migratory fish into the Clark Fork River upstream of the dam. A creel census conducted in 1955 indicated that bull trout made up 50 percent of the game fish taken during the regular fishing season. The catch rate for bull trout during this season was 0.17 fish per hour. Gill-netting in Cabinet Gorge indicated that 2 percent of the fish population (35 percent of game fish) to be bull trout (Gaffney 1955).

In the years since the dam was constructed, bull trout numbers have declined, although both bull and westslope cutthroat trout populations persist in low numbers (Huston 1993). Bull trout were collected in 1985 at stations C-1 and C-2 in Cabinet Gorge Reservoir near and just upstream of the mouth of Rock Creek. No bull trout were collected at the two downstream stations (Barnard and Vashro *In* ASARCO, Incorporated 1987-1994).

Bull trout populations in Cabinet Gorge are supported by two tributaries; the Bull River and Rock Creek. Redd (fish nests) count data from the Bull River indicate between 12 and 16 redds in 1992 and 1993 (Pratt and Huston 1993). Pratt and Huston (1993) characterized this population as stable but fragile. The small number of nursery streams increases the probability that the population will be unable to recover from catastrophic events. In addition, the bull trout population is low enough to create questions about maintaining genetic diversity in the population. Huston (1993) noted a potential threat to bull trout in this drainage; the possibility of brown trout spawning on top of bull trout redds.

Westslope cutthroat trout were collected at station C-2 in Cabinet Gorge Reservoir in 1985 and then only in July (Barnard and Vashro *In* ASARCO, Incorporated 1987-1994). Yellowstone cutthroat trout were stocked in Cabinet Gorge Reservoir in the 1950s (Huston 1993). Yellowstone cutthroat trout interbreed with westslope cutthroat trout. The genetic status of cutthroat trout is unknown in Cabinet Gorge Reservoir. However, westslope cutthroat trout in the Bull River drainage were found to be either pure strain or "pure for management purposes" (Huston 1993).

Lake Pend Oreille

General Description

Lake Pend Oreille is the largest and deepest natural lake in Idaho. The surface elevation is regulated by the Albeni Falls Dam, located on the Pend Oreille River 23 miles downstream (Maiolie 1991). Most of the lake's volume is contained in the southern basin that has a mean depth of 715 feet. The northern arm of the lake has a mean depth of 98 feet (Hoelscher 1993).

The Clark Fork River is the lake's principal inlet, contributing as much as 90 percent of the lake's annual inflow (Beckwith 1989). The only surface outlet is the Pend Oreille River.

Aquatic Plants

Lake Pend Oreille contains five groups of algae, with diatoms encountered most frequently. The golden-brown algae occasionally dominate when *Rhodomonas minuta* grows rapidly. Nuisance blue-green algae are rare. Total algal biomass in the lake is quite low, however, the potential for moderately high production is present. Algae may currently be limited by a phosphorus and/or nitrogen deficiency (Priscu 1989).

Aquatic Invertebrates

Eleven species of crustacean zooplankton have been identified in Lake Pend Oreille (Rieman and Bowler 1980). Of these, five species, including opossum shrimp (*Mysis relicta),* composed most of the zooplankton community. Opossum shrimp were introduced into Lake Pend Oreille in 1966, and were well established by 1974. Changes in the zooplankton community since in 1974 suggest that opossum shrimp introductions have had a major effect on the native zooplankton community (Hoelscher 1993).

Fish

Of the approximately 20 game fish species present in Lake Pend Oreille, only westslope cutthroat trout, bull trout, and mountain whitefish are native. Other fishes include a variety of nongame species (Hoelscher 1993).

Lake Pend Oreille is an important fishery resource in Idaho. However, salmonid populations declined dramatically between the 1950s and 1980s. The completion of Cabinet Gorge Dam in 1951 on the Clark Fork River eliminated 90 percent of the available spawning and rearing habitat for migratory fishes (Irving 1986). Albeni Falls Dam, completed in 1952, caused winter drawdowns that dewatered shoreline spawning areas and killed kokanee eggs in the gravel. Currently, only 10 miles of Clark Fork River up to Cabinet Gorge Dam and 102 miles of smaller tributaries to Lake Pend Oreille and the river are available to migratory fishes for spawning (Hoelscher and Bjornn 1989). Improper land management practices, natural catastrophes, and the introduction of opossum shrimp also have been identified as causes of fishing declines.

Metals Concentration in Fish Tissues

In the fall of 1989, the Idaho Department of Fish and Game collected fish samples from the Clark Fork River and Lake Pend Oreille. Arsenic, chromium, and the organic compounds tested were not detected in any samples above the method detection limits (Hoelscher 1993). All other heavy metals -- cadmium, copper, lead and mercury -- were either nondetectable or well below action limits[4] except mercury in northern squawfish. Regular consumption of northern squawfish could cause mercury intoxication in humans. Consumption of all other fish should pose no health problems.

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[4] Federal and state guidelines for metals concentrations in fish tissue have not been officially established. However, the Food and Drug Administration has set an action limit for mercury in edible fish at 1.0 ppm wet weight. In addition, the Food and Agriculture Organization of the United Nations has published a compilation of international legal limits for hazardous substances in fish (Nauen 1983). Hoelscher (1993) used the median of these legal limits as guidelines for evaluation of these data.

Threatened, Endangered, and Sensitive Species

The Lake Pend Oreille bull trout population appears stable, but this stability is fragile or tentative. Currently, there are about 1,100 to 2,000 bull trout available to spawn annually in tributaries to Lake Pend Oreille based on a long-term data set. Of the 16 nursery areas supporting the Lake Pend Oreille population, only two support stable stocks. High annual variation of a spawning population suggests a high risk of extinction (Pratt and Huston 1993).

The present low densities of juvenile westslope cutthroat trout in accessible Lake Pend Oreille tributaries and the decline in westslope cutthroat harvest since monitoring began indicate a depressed migratory population. Possible reasons for the decline include habitat loss, overexploitation, migration blocks, and competition and interbreeding with introduced rainbow trout (Hoelscher 1993).

BIODIVERSITY OF WILDLIFE HABITAT/VEGETATION AND WILDLIFE SPECIES (BIODIVERSITY)

Introduction

Wildlife and vegetation are interwoven subjects that are part of a larger relationship called biodiversity. Biodiversity, as defined by Wilcox, is a term that describes the variety of lifeforms, the ecological role they perform, and the genetic diversity they contain (Wilcox 1984 *In* Wilson 1988). Therefore, the discussion of ecological subjects, such as wildlife and vegetation, as separate, unrelated resources is difficult, if not inappropriate. For this reason, wildlife and vegetation are presented together in an attempt to display their ecological ties. The intent of this section is to address some aspects of the very complex concept of biodiversity.

Wildlife Habitat/Vegetation

Aspects of biodiversity that are discussed in this section include: plant species of special concern, noxious weeds, vegetative communities, old growth ecosystems, and habitat fragmentation. Discussions of these subject areas will help set the stage for understanding potential impacts to the integrity of habitat.

Plant Species of Special Concern

The U.S. Fish and Wildlife Service is charged with maintaining a list of threatened or endangered species and reviewing candidate (additional) species for possible listing (see Threatened and Endangered Species). The Forest Service has developed a program to identify and manage threatened or endangered plant species that also focuses on plant population viability and habitat management. As part of this program, the Forest Service has developed the "sensitive" classification, in an effort to preclude trends toward species endangerment that would result in the need for federal listing (Leavell and Triepke 1993). Sensitive species are discussed in greater detail in the Biological Evaluation for Plant Species on file with KNF.

The Montana Natural Heritage Program (MTNHP) maintains a database and conducts inventories for plant species of special concern. The MTNHP provides a clearinghouse for information among various entities including state agencies, USFWS, Forest Service, and others. The MTNHP is currently tracking 379 plant taxa, some of which are not listed by federal agencies.

Forty-three plant species of concern were identified as potentially occurring in the study area. Five of those species were found during ASARCO's baseline field studies.

Crested shield-fern (*Dryopteris cristata*), listed as sensitive by KNF, was located in the study area. Two other species located during field inventories and listed by the MTNHP as plant species of concern were pointed broom sedge (*Carex scoparia*), and yerba buena (*Satureja douglasii*). Two other plant species of concern were also identified in the study area; black snake-root (*Sanicula marilandica*), and fringecup (*Tellima grandiflora*).

- **Crested shield-fern**. Crested shield-fern is found in wet soils, usually at the margins of bogs or fens in the montane zone from elevation 3,000 to 4,500 feet. It is not known how this plant responds to management activities (Leavell 1994). Crested shield-fern was identified in three locations in the project area where thick mossy areas occur on bedrock seeps or along bouldery stream margins. These sites are within jurisdictional wetlands or Waters of the U.S. (ASARCO, Incorporated 1993).

- **Pointed broom sedge**. Pointed broom sedge is generally found on moist or wet low ground at lower elevations. One population was located in the permit area. It is listed by MTNHP as globally secure but critically imperiled in the state due to extreme rarity (Montana Natural Heritage Program 1995).

- **Yerba buena**. Yerba buena is generally found in partially to deep shady areas of moist, coniferous forests (Lesica and Shelly 1991). The plant occurs commonly in the permit area along the terrace of the Clark Fork River (Scow et al. *In* ASARCO, Incorporated 1987-1994; Montana Natural Heritage Program 1994). Yerba buena is listed by MTNHP as apparently secure globally but imperiled in the state due to rarity (Montana Natural Heritage Program 1993).

- **Black snake-root**. Black snake-root generally is found on moist low ground to damp wooded slopes. The plant is relatively common within the permit area and has been recorded at four sites (Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994; WESTECH 1993). Black snake-root was found in the moist western hemlock and western red cedar habitat types and in the herbaceous wetland community. Black snake-root is listed by the Idaho Natural Heritage Program (IDNHP) as globally secure but critically imperiled because of extreme rarity in Idaho (Mosely and Groves 1990). Black snake-root is not listed by MTNHP nor by KNF but is listed by the Idaho Panhandle National Forest (Montana Natural Heritage Program 1995; U.S. Forest Service 1991; U.S. Forest Service, Kootenai National Forest 1993).

- **Fringecup.** Fringecup is generally found in moist woods, along streams and on lower mountain slopes. One population was located in the permit area. The site is normally saturated late into the growing season. The site has been altered by changes in the Rock Creek channel and by logging (WESTECH 1993). Fringecup is not currently listed by the IDNHP, MTNHP, or the KNF (Montana Natural Heritage Program 1995, Mosely and Groves 1990, U.S. Forest Service 1991). However, a proposed revision to the Forest Service Region 1 list may include fringecup (Steve Shelly, U.S. Forest Service Region 1, in a letter to WESTECH, November 1993).

Noxious Weeds

Under the Montana's County Noxious Weed Control Act (Title 7-22-2101 to 2153), it is unlawful to allow noxious weeds to propagate. Fifteen plant species, designated as noxious, are currently listed in the rules (ARM 4.5.201-204). The Sanders County Weed Board has designated 16 species including those recognized by the state. Sanders County and the KNF are working cooperatively such that the County has taken on the responsibility of controlling noxious weeds in the Rock Creek drainage.

Four species from this list have been observed within the project study area (Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994). They are spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), St. Johnswort or goatweed (*Hypericum perforatum*), and sulphur cinquefoil (*Potentilla recta*). Canada thistle was observed in only minor amounts in the project area.

Typically, weeds get a foothold in areas where disturbance has occurred. Spotted knapweed is an aggressive invader of dry to moist sites. Lacey et al. (1992) noted that spotted knapweed-infested range and open timberlands have drastically reduced big game use and forage base. Also, runoff and sediment yield are higher on knapweed infested lands. Spotted knapweed occurs throughout the study area. Particularly high coverages occur in cleared areas, especially in the powerline corridor and vicinity. Spotted knapweed occurs along all roads including the Chicago Peak Road and was also found as a component of all Douglas-fir communities. St. Johnswort, which is unpalatable and mildly poisonous to livestock, was observed in similar locations but its coverage was spotty or minor. Both spotted knapweed and St. Johnswort were found in recent clearcuts.

Sulphur cinquefoil is similar to spotted knapweed in site requirements and aggressive spreading behavior and is unpalatable to livestock and wildlife (Rice et al. 1991). It is rapidly becoming co-dominant in many areas in western Montana heavily infested with spotted knapweed (Rice et al. 1991). Only very minor amounts of sulphur cinquefoil were noted in cleared areas.

Vegetative Communities

The proposed project area occurs in an ecologically diverse area. The area is characteristic of the Northern Rockies and reflects the influences of both Pacific maritime and continental climates. Elevation, aspect, topographic position, soils, and management activities affect the specific plant communities that occur. Low-elevation mesic forested communities are present as well as high, craggy, alpine areas.

The majority of the vegetation study area, except the tailings impoundment, falls within the Rock Creek watershed, designated by the Forest Service as timber Compartment 711. About 61 percent of the land in Compartment 711 is forested with assorted conifer species, 16 percent is nonforested, and 23 percent is not described (U.S. Forest Service 1994). Rock Creek is the dominant creek that flows through the project area, though several other creeks occur. Riparian and wetland communities, though comprising a small percentage of the landscape, are a very rich ecological component of the area. Approximately 46 percent of the compartment occurs above 4,800 feet and generally possesses alpine characteristics such as dwarfed trees and plants and rugged terrain.

Current forest cover in Compartment 711 is dominated by Douglas-fir stands (43 percent) and cedar-western hemlock stands (28 percent). Other assorted conifer stands account for the remaining forested lands (29 percent). Eighty-five percent of the timbered stands is a mix of immature sawtimber (trees with a diameter at breast height [dbh] of 5 feet to 9 feet) and mature sawtimber (trees with a dbh greater than 9 feet). Smaller trees, such as seedlings, saplings and poles, are found on 15 percent of timbered lands (U.S. Forest Service 1994). The predicted future of potential forest type, which is determined through a technique called forest habitat typing (Pfister et al. 1979), suggests that about 60 percent of the area will successionally move towards climax communities of cedar-hemlock or grand fir and 30 percent to subalpine fir or mountain hemlock. Forest habitat types are useful in predicting future forest communities but do not necessarily reflect existing stand condition. Maps displaying forest habitat typing for the permit area are found in the baseline vegetation study (Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994).

Table 3-22 lists common plants found in the communities identified within the proposed permit boundary. Dense shrub understories occur in several communities and include tall shrubs such as huckleberry, pacific blackberry, rusty menziesia, baldhip rose, snowberry, and Rocky Mountain maple and low shrubs such as twinflower, spirea, and creeping Oregon grape. Grass and forb cover is relatively low in many communities because the tree and shrub canopy shades out and competes with these species. Columbia brome, elk sedge, pinegrass and northwest sedge are typical grasses and grass-like plants that occur. Common goldthread, bracken, and wild sarsparilla are typical forbs that occur.

Openings created by roads, powerline corridor, and other disturbances are dominated by herbaceous species, many of which are either not native to North America or are not typical of intact forested communities in the area. Species include Canada bluegrass, Kentucky bluegrass, timothy, oxeye daisy, and several clovers. Introduced species have become established to some extent in the lower elevation and/or drier communities primarily when they are adjacent to the artificial openings. Clear-cut areas occur in all community types identified. However, of the clearcuts inventoried, introduced species were not usually a common component.

Some portions of the project area that extend beyond compartment 711 occur in or near the CMW. This alpine area is characterized by rugged, rocky terrain with patchy subalpine fir stands. Small inclusions of alpine meadows and sidehill open parks dot the landscape. Several small lakes, such as Cliff and Copper lakes, are present in the glaciated basins.

TABLE 3-22.
Representative Plant Species by Dominant Vegetation Type and Lifeform Class[1]

Vegetation Type			
	Lifeform Class		
Trees	Shrubs	Forbs	Graminoids[2]
BASELINE STUDY AREA			
Artificial Opening (56/12%)[3]			
Lodgepole pine	Pacific blackberry	Spotted knapweed	Common timothy
Western white pine	Wild carrot	Canada bluegrass	
Douglas-fir/mallow ninebark (66/11%)			
Douglas-fir	Rocky Mountain maple	Bracken	Pinegrass
Lodgepole pine	Creeping Oregongrape	Spreading dogbane	Columbia brome
Grand fir/beadlily (79/2%)			
Douglas-fir	Blue huckleberry	Bracken	Northwest sedge
Western larch	White spirea	Western goldthread	Elk sedge
Western red cedar/beadlily (99/30%)			
Lodgepole pine	Western twinflower	Western goldthread	Columbia brome
Western red cedar	Pacific blackberry	Bracken	Pinegrass
Western red cedar/devil's club (41/2%)			
Western hemlock	Rocky Mountain maple	Coolwort foam flower	Tall trisetum
	Devil's club	Lady-fern	Dewey's sedge
Western hemlock/beadlily (145/41%)			
Western hemlock	Western twinflower	Bracken	Pinegrass
Western red cedar	Pacific blackberry	Beargrass	Northwest sedge
EXPLORATION ADIT STUDY AREA			
Mountain hemlock/rusty menziesia (27/<1%)			
Mountain hemlock	Rusty menziesia	Beargrass	minor component
Subalpine fir	Blue huckleberry		
	Grouse whortleberry		
Scree/shrubfield (13/<1%)			
minor component	Rusty menziesia	Beargrass	minor component

Source: Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994.

[1] Study area = 2,017 acres.

[2] Grasses, sedges, rushes

[3] First number indicates total number of species identified in the community type; second number indicates percentage of the total area disturbed (Alternative II) that is occupied by the community type.

Note: Other community types identified include western red cedar/oak fern, western red cedar/lady fern, western hemlock/wild ginger*, western hemlock/oakfern*, Douglas-fir/common snowberry, Douglas-fir/scree, subalpine fir/beadlily, and unvegetated or disturbed areas; these types, combined, comprise <3% of the study area.

* indicates <1% would be disturbed.

Riparian Communities found in the general project area are composed of a diversity of trees, shrubs, herbs, grass and grass-like plants. These areas are commonly found along the creeks (such as Rock Creek), tributaries, and bodies of water. Exact acreages and locations of riparian areas in the project area are unknown, though some were identified during wetland delineations (see Waters of the U.S. and Wetlands). A cursory estimate of riparian acres in Compartment 711 is 1,120.

Wetlands are discussed in detail in Waters of the U.S. and Wetlands. These communities, typical of the geographic region, tend to be thickly vegetated with a variety of shrubs, forbs, grasses, and grass-like plants. Wetlands are limited in the project area, increasing their importance.

Old Growth Ecosystems

Old growth forests are complex ecosystems that develop over long periods of time (usually hundreds of years). While different ecological types of old growth occur, common stand attributes are usually present. These include the occurrence of: multiple forest canopies; large, standing live trees; large, standing dead trees (also called snags); downed logs or woody debris; thick duff layer; rot or decaying forces; and the ability of the stand to moderate weather conditions. The combination of these attributes creates a unique environment.

Forty percent of the 373 wildlife species estimated to occur in the northern region of the Forest Service are thought to use old growth forests for feeding and/or reproduction (Harger 1978 *In* Warren 1990) and more than 50 animal species on the KNF are known to prefer old growth forest habitats (U.S. Forest Service 1987). Loss of old growth ecosystems results in a loss of biodiversity.

The minimum size of an old growth stand required by old- growth-associated-species is dependent upon several factors such as: the habitat needs of the particular species; the type and quality of the old growth stand; and the nature of the adjoining landscape. Pileated woodpeckers, for example, require a minimum of 100 contiguous acres of old growth forests for nesting habitat (Aney and McClelland 1990). Marten require a minimum 250 to 500 contiguous acres of old growth, depending on the quality of the stand (Burke *In* Warren 1990; Soutiere 1979) and interior forest birds are thought to need more than 250 contiguous acres of old growth habitat (Wilcove, McClellan, and Dobson *In* Warren 1990). A 1000-acre unit size is thought to provide the needs of all old-growth-related species (Munther, Drebeit, and Hills *In* U.S. Forest Service 1987). Others have recommended a 125-acre block of old growth as a minimum size to provide effective habitat for vertebrate wildlife (Rosenburg and Raphael 1986).

Adjacent landscapes can modify the effectiveness of old growth stands. This phenomenon, referred to as edge effect, can reduce habitat effectiveness to a point that a stand no longer functions as an old growth ecosystem. For example, an old growth stand 25 acres in size is completely modified by edge and is ineffective old growth habitat. An 80-acre stand is reduced to 50 percent effectiveness because of edge effect (Lemkuhl and Ruggerio 1991). Stand size, shape and juxtaposition in the landscape, therefore, influence its effectiveness as functioning habitat.

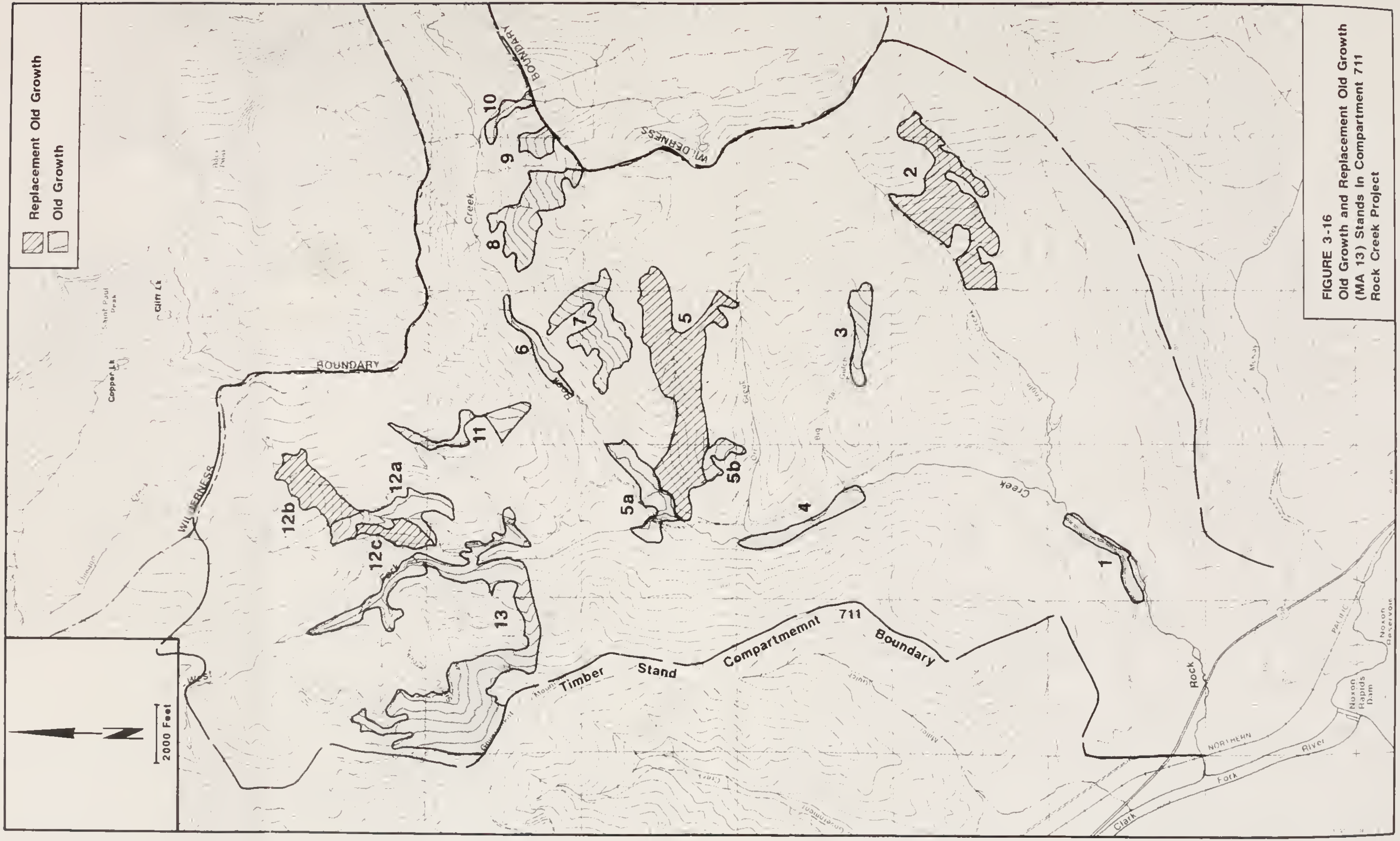

FIGURE 3-16
Old Growth and Replacement Old Growth (MA 13) Stands In Compartment 711
Rock Creek Project

Source: Kootenai National Forest

In addition to stand size, shape, and juxtaposition, the amount of old growth habitat in a drainage is important to long-term viability of old growth associated species. It is estimated that, at a minimum, 8 to 10 percent of a drainage needs to be functioning old growth to meet these biological needs.

Compartment 711 has limited old growth habitat (see **Table 3-23** and **Figure 3-16**). Past logging, forest management, and fire history have removed old growth and left most of the remaining old growth stands fragmented and small in size. Old growth management, as related to the KNF forest plan, is discussed under Forest Plan.

TABLE 3-23.
Summary of Existing Old Growth (OG) and Replacement Old Growth (ROG) Acreage Designated as MA 13 in Timber Compartment 711

Stand Number	Block Number	OG	ROG
1	1	45	0
2	2	0	191
3	3	90	0
6	4	30	0
5	5	0	241
5a	5	63	0
5b	5	30	0
6	1	30	0
7	4	90	0
6	5	45	0
6	5	22	0
13	10	21	0
11	11	90	0
12a	10	70	0
12b	12	0	70
12c	12	0	35
13	13	392	0
Total Acreage		977	537
Percent of Rock Creek Compartment 711*		7.0	3.9

Source: Kootenai National Forest, Cabinet Ranger District 1995.
Note: Total area in Rock Cr. Compartment 711 is 13,923 acres.
[1] Timber stand 8, 9, and 10 are in MA2 Semi-primitive Non-motorized Recreation.

Thirteen old growth stands on NFS lands, totalling 977 acres, were identified (see **Figure 3-16**). The stands ranged from 16 to 392 acres with an average size of 80 acres. Habitat for old-growth-associated species that require stand size greater than 100 acres is scarce in this compartment. Two stands are greater than 100 acres. The majority (62 percent) of old growth stands are less than 50 acres in size and 92 percent are below 100 acres. Seven percent of the drainage is old growth habitat, below the biological minimum.

Approximately 50 percent of the stands, which are linear or finger-like in shape, are found along riparian zones, creeks and draws. These stands tend to be cedar-hemlock old growth types with remnant, well-decayed larch snags present. The other 50 percent of the stands, commonly found mid-slope, are typically mixed conifer or Douglas-fir/larch old growth type. Roads fragment or run adjacent to 60 percent of the old growth stands. Approximately 50 to 75 percent of the stand perimeters are adjacent to openings (either cutting units or scree). Old growth stands are scattered throughout the compartment providing some dispersal corridors.

The quality and effectiveness of the designated old growth habitat is compromised by road presence, small stand size, and location adjacent to openings. The ability of the Rock Creek drainage to sustain, overtime, viable local populations of diverse old-growth-associated species is unlikely.

Old-growth-associated avian species, observed during the baseline study, or are thought to occur in the vicinity, include barred owl, great grey owl, Vaux's swift, black-backed woodpecker, red-breasted nuthatch, white-breasted nuthatch, pygmy nuthatch, brown creeper, hermit thrush, varied thrush, and Townsend's warbler and nesting pileated woodpeckers. The northern goshawk was observed on five occasions, three of which were in old growth stands.

Old growth associated mammals that were observed, or are suspected to occur in the Rock Creek area, include northern flying squirrel, red-backed vole, Townsend's big-eared bat, marten, wolverine, and fisher.

Habitat Fragmentation

Land management activities, such as timber harvest and road building, divide or fragment vegetative communities and habitats. This phenomenon, referred to as fragmentation, leaves habitats such as forests, as patches or islands of varying size and isolation (Harris 1984), resulting in the loss of effective wildlife habitat and biological diversity. Species needing large unbroken tracks of forests are declining or disappearing as fragmentation occurs (Harris 1984; Wilson 1988).

Forested habitats are fragmented in the study area. Roads extending up Rock Creek, a major drainage, have dissected wildlife habitat and interrupted wildlife travel corridors. These would be about 47 miles of roads in the area. The average road density in an area encompassing Compartment 711 and parts of McKay Creek drainage (BAAs 7-6-1 and 7-5-2) is 1 mile of open road per square mile. Timber harvesting, either partial cutting, thinning, or clearcutting, has occurred on 22 percent of the lands in Compartment 711.

Wildlife Species

Aspects of biodiversity that are discussed in this section include sensitive wildlife, management indicator species, and other selected wildlife groups. The Rock Creek area has a variety of communities and landscape features that provide diverse habitat for numerous species. Farmer and Heath *In* ASARCO, Incorporated 1987-1994) estimated that 156 bird species, 45 mammal species, six reptile species and five amphibian species are likely to occur within the wildlife study area. Many of these species have state or federal designations that indicate ecological, regulatory, or management-related status (see **Table 3-24**). Eleven of these species are designated as federally threatened, endangered, or are candidates for listing. Ten are Forest Service sensitive species. Nineteen are game species (managed for sustainable hunting or trapping). Thirty-six are DFWP species of special concern, and eight species are Forest Service management indicator species. Some species share more than one designation.

Sensitive Wildlife Species

Sensitive species are those animal species identified by the Forest Service for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and/or in habitat capability that would reduce a species' existing distribution (Reel, Schassberger, and Ruediger 1989). Sensitive species are often rare and their ecology sometimes not well understood. Only those sensitive species that may occur within or near the project area are discussed below. A more detailed discussion may be found in the Biological Evaluation completed for sensitive species on file at KNF.

Harlequin Duck. Harlequin ducks are unique sea birds that migrate inland to mountain streams during spring to nest and raise their broods. They return to coastal areas for fall and winter. Breeding harlequins have a strong fidelity to the same stream year after year (Reel, Schassberger, and Ruediger 1989; Kuchel 1977; Wallen 1989; Cassirer and Grove *In* Cassirer et al. 1993). They require solitude, are easily disturbed, and generally, are not found along streams with more than occasional human activity (Reel, Schassberger, and Ruediger 1989; Clarkson *In* Reichel and Genter 1995; Cassirer and Groves 1991 *In* Reichel and Genter 1995) Harlequins usually nest in a variety of habitats close to streams (Reichel and Genter 1995). Adept swimmers, harlequins forage for aquatic insects in fast-flowing streams.

The number of harlequin ducks has been declining (Cassirer et al. 1993). In the lower 48 states, the harlequin duck is considered to be in a tenuous state in the contiguous United States and is geographically fragmented. It is a candidate species for listing under the Endangered Species Act.

Population estimates for Montana are at 120 to 150 breeding pairs (Jim Reichel, Montana Natural Heritage Program, personal communication, June 6, 1995) and for Idaho are estimated at 50 breeding pairs (Cassirer et al. 1993). Harlequin numbers are low and the species is geographically fragmented. Groups of breeding streams could be considered to sustain a harlequin subpopulation. One of these groups or subpopulations occurs in the lower Clark Fork drainage in the Noxon/Trout Creek area. Rock Creek is one of the four streams in the lower Clark Fork drainage that supports breeding harlequins. It is also one of the 25 to 30 breeding streams in Montana. The lower Clark Fork subpopulation is

TABLE 3-24.
Wildlife With Selected State or Federal Designations That May Occur in Project Vicinity

Elk (MIS)
Fisher (S; SPSC)
Grizzly Bear (LT; MIS; SPSC)
Hoary Marmot (SPSC)
Lynx (C2; S; SPSC)
Mountain Goat (MIS; SPSC)
Northern Bog Lemming (S; SPSC)
Northern Rocky Mountain Wolf (LE; MIS; SPSC)
Pygmy Shrew (SPSC)
Townsend's Big-eared Bat (S; SPSC; C2)
White-tailed Deer (MIS)
Wolverine (C2; S; SPSC)
Woodland Caribou (C2; SPSC)

Coeur d'Alene Salamander (S; SPSC)
Pacific Giant Salamander (SPSC)
Rough-skinned Newt (SPSC)
Spotted Frog (C2)
Tailed-frog (SPSC;C2)

Bald Eagle (LE; MIS; SPSC)
Barred Own (SPSC)
Black-backed Woodpecker (S)
Bobolink (SPSC)
Boreal Owl (S)
Burrowing Owl (SPSC)
Cooper's Hawk (SPSC)
Ferruginous Hawk (SPSC; C2)
Flammulated Owl (S)
Golden Eagle (SPSC)
Great Grey Owl (SPSC)
Harlequin Duck (C2; S; SPSC)
Loggerhead Shrike (C2)
Long-eared Owl (SPSC)
Merlin (SPSC)
Northern Goshawk (C2; SPSC)
Northern Pygmy Owl (SPSC)
Northern Saw-whet Owl (SPSC)
Olive-sided Flycatcher (SPSC)
Osprey (SPSC)
Peregrine Falcon (LE; MIS; SPSC)
Pileated Woodpecker (MIS; SPSC)
Prairie Falcon (SPSC)
Upland Sandpiper (SPSC)
Western Bluebird (SPSC)

Designation Codes:

SPSC = State species of special concern
LE = Federally listed as endangered
LT = Federally listed as threatened
C2 = Candidate species for federal listing
S = Designated Forest Service sensitive species
MIS = Forest Service management indicator species

Source: Flath 1984; Reel et al. 1989; U.S. Fish and Wildlife Service 1995.

estimated to have a maximum of 15 breeding pairs (J. Reichel, pers.comm., June 6, 1995). Three of these pairs are found on Rock Creek.

Fisher. The fisher, a type of weasel, feeds on a variety of prey from small to medium sized mammals, birds, and carrion (Powell *In* Ruggiero et al. 1994). It is well known for its ability to effectively prey on porcupines.

Fishers, generally, are more common where human density is low and human disturbance is reduced (Ruggiero et al. 1994). The fisher is characterized as a species that avoids humans (Douglas and Strickland, and Powell *In* Ruggerio et al. 1994), though fishers are known to tolerate low levels of human disturbance (Heinemeyer and Jones 1994).

In the western United States, fishers prefer late-successional forests (mature or old growth forests) and low elevation, moist riparian corridors for resting, denning, and travel (Heinemeyer *In* Heinemeyer and Jones 1994). An assortment of habitats are used for feeding. They avoid non-forested areas (Jones, Jones and Garten, and Roy *In* Ruggiero et al. 1994). Some suitable habitat for fishers is found within Rock Creek drainage and in the project area. The low-elevation moist and riparian sites along Rock Creek and old growth and mature forested stands supplies some preferred habitat. The quality of fisher habitat in Rock Creek drainage has been compromised due to forest fragmentation, loss of old growth habitat, and the occurrence of roads adjacent to or in riparian zones.

Fisher populations declined substantially during the late 19th century and early 20th century due to human activities such as logging, other habitat alteration, and trapping. Populations were eliminated over much of their former range in the United States and eastern Canada (Ruggiero et al. 1994). Fishers have recovered in some areas (due to re-introduction programs, management actions, and partial habitat restoration) especially in the eastern United States, but remain fragmented in the western United States (Ruggiero et al. 1994). In the western United States, fisher populations are limited to selected mountain ranges in the Pacific northwest and Rocky Mountains. These isolated populations may be acutely susceptible to extinction (Heinemeyer and Jones 1994).

Fishers once occurred in the Cabinet Mountains but were eliminated from the area due to overtrapping and habitat alteration (Ruggiero et al. 1994). A recent re-introduction program to establish the fisher back into the Cabinets has met with limited success (Ruggiero et al. 1994). During the late 1980s and early 1990s, a total of 110 fishers were transplanted to the Cabinet Mountain range (Heinemeyer and Jones 1994). Transplanted fishers suffered high mortality rates and dispersed long distances (Roy 1991; Heinemeyer and Jones 1994). Incidental trapping (such as those fishers caught in bobcat, marten or coyote traps) and death from predators accounted for substantial losses. The current population of fishers in the Cabinet Mountains is unknown. During a study of the transplanted fishers, Heinemeyer (*In* Heinemeyer and Jones 1994)) found that fishers use Rock Creek drainage, and appear to select for coniferous riparian habitats adjacent to creek. One of these fishers, a female, uses the Rock Creek drainage as her homerange.

Lynx. Lynx are solitary animals often associated with remote areas. They often use early unsucessional plant communities at high elevations for foraging and mature to old growth forests with downed trees for denning and possible foraging (Weaver 1993). The distribution and abundance of the lynx appears to be tied to the snowshoe hare, their main prey (Ruggiero et al. 1994). Lynx avoid openings, such as clearcuts and grasslands. Open areas, whether human-made or natural, will discourage use by lynx and disrupt movement (Koehler 1990; Koehler and Brittell 1990 *In* Ruggiero et al. 1994). They are easily trapped intentionally or unintentionally through bobcat or coyote traps. Humans are considered to be the single most important mortality factor for lynx (Ward and Krebs 1985 *In* Ruggiero et al. 1994).

Range of the lynx in the western contiguous United States has diminished over the last century. Habitat is more fragmented and restricted, which may cause the lynx to be less tolerant of human activities than in Canada and Alaska where refuge habitats occur (Ruggiero et al. 1994). Population of the lynx in western United States and specifically Montana is unknown. During the early- to mid-1980s, declines in lynx harvest occurred even though effort to trap lynx were high. As a result, to try and prevent overharvesting, state harvest quotas were incrementally lowered from 135 animals in 1982 to two in 1991. While northwestern Montana is considered a stronghold for lynx in the lower 48 states, populations are very low and depressed (Lori Nordstrum, United States Fish and Wildlife Service, personal communication, June 5, 1995). Currently, the lynx is a candidate species for listing under the Endangered Species Act.

The status of the lynx in the project area and in the Cabinet Mountains is unknown. While lynx are considered to occur, populations are probably low. Trapping records suggest this, as only three lynx were trapped in Sanders County from 1977 to 1993 and all three were taken in 1984. Lynx habitat and prey are present in and adjacent to the project area.

Wolverine. The wolverine is a very secretive animal generally associated with remote areas with little human activity or development (Hash 1987). They are far-traveling animals with large home ranges. A scavenger and effective predator, the wolverine is an opportunistic feeder taking a wide variety of food (Hash 1987). Habitat requirements for wolverine appear to be “large isolated tracks of wilderness supporting a diverse prey base, rather than specific plant associations or topography” (Banchi *In* Butts 1992).

The decline of the wolverine population during the late 1800s and early 1900s in the continental United States has been attributed to overtrapping and habitat degradation. This continues to threaten wolverine recovery. The wolverine is currently a candidate species for listing under the Endangered Species Act and is protected from harvest as a furbearer in all the lower 48 states except Montana. Harvests in Montana were 11 in 1989, 7 in 1990, and 5 in 1991 (Hinz *In* Butts 1992). Because of the difficulty, expense, and commitment required to study wolverines, little information is known about the population status in the lower 48 states and specifically, in Montana. Under best conditions, wolverines densities are low (Butts 1992) and widespread in western Montana (Hash 1987).

Habitat for the wolverine is present in the project area and adjacent CMW. The Rock Creek drainage provides winter habitat along the low-elevation riparian areas, travel corridors, and summer habitat in the higher-elevation, subalpine fir forests. The solitary nature of wolverines results in few sightings of this animal. A recent sighting of a wolverine in Rock Creek in 1993 (Harvey Nyberg, Department of Fish, Wildlife and Parks, personal communication, June 10, 1994) and fresh wolverine tracts observed during the wildlife baseline study (Farmer and Heath *In* ASARCO, Incorporated 1987-1994) suggest that wolverines use the Rock Creek drainage as part of their range.

Townsend's Big-eared Bat. The Townsend's big-eared bat uses a variety of habitats. Key components of their habitat are caves and abandoned mine tunnels which they use for winter roost and nursery sites. During the summer, tree cavities, abandoned buildings, and bridges are also used as roost sites. The bats forage for insects, their main diet item, in a variety of areas. Wetlands and moist sites are productive foraging areas for bats, as they produce an abundance of insects. Winter and primary nursery habitat is not known to occur in the project area. Summer and foraging habitat is present throughout the project area.

The status of Townsend's big-eared bat in Rock Creek drainage is unknown. Surveys for the bat have not been conducted in this area. Bats are known to occur in the drainage, however, the species are unknown.

Black-backed Woodpecker. Black-backed woodpeckers are often associated with recently burned or bug-infested coniferous forests, though they do occur in a variety of other habitats. Habitat for the black-backed woodpecker is present throughout the project area, however, preferred areas of recent burns or bug infestations are not present at this time.

Black-backed woodpeckers were observed during the baseline wildlife studies (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). The current population is unknown.

Coeur d'Alene Salamander. Coeur d'Alene salamanders are found in three general habitats; spring seeps, waterfall spray zones, and streamsides of small cascading creeks (Reel, Schassberger, and Ruediger 1989). A streamside splash zone along Rock Creek provides a limited area of suitable habitat within the project area. Surveys conducted at the site did not reveal the salamander, however, results of one survey are not conclusive. Other areas providing suitable habitat in the project area have not been identified.

Boreal Owl. Boreal owl habitat, high-elevation, mature spruce/subalpine fir communities, is not common in Compartment 711. Lands found within the adjacent CMW may provide suitable habitat, but inventories have not been completed. The status of boreal owls in the Rock Creek area is unknown. Surveys conducted in Orr and Cedar gulches in 1993 did not reveal the owl (Bob Summerfield, Kootenai National Forest, in a memo to Lisa Fairman, March 10, 1995). However, lack of responses to calls during the surveys is not conclusive of the absence of owls.

Flammulated owl. Preferred habitat for the flammulated owl, mature or old growth ponderosa pine stands, is rare in the Rock Creek drainage. However, mature or old growth Douglas-fir stands are also thought to provide habitat for the owl (Reel, Schassberger, and Ruediger 1989). Isolated Douglas-fir old growth stands, totalling an estimated 700 acres, occur in the Rock Creek Compartment. The status of flammulated owls in Rock Creek is unknown. Surveys have not been completed.

Northern Bog Lemming. Bog lemming habitat is considered to be sedge-alder bogs and spruce-fir or lodgepole pine forests (Hoffman and Pattie 1968). The closest known habitat occurs at Rock Creek Meadows in the East Fork of Rock Creek. Surveys conducted in this area in 1992 did not reveal the presences of bog lemmings (J.Reichel, per. comm., March 20, 1995). However, the lack of findings is not conclusive of the absence of lemmings. Occurrences of Northern bog lemmings in Montana are rare.

Forest Service Management Indicator Species

KNF has identified eight wildlife species that are used to monitor the effects of planned management activities on groups of wildlife habitat and/or species. Four of these species -- mountain goat, elk, white-tailed deer, and pileated woodpecker -- are discussed here. The others are addressed in the Threaten and Endangered Species section.

Mountain Goat. Mountain goats are the selected indicator species for alpine habitat and animals. They are a unique species, highly specialized for rugged alpine habitats. Goats traditionally use the same summer and winter ranges, travel corridors, kidding areas, and mineral licks year after year, rarely exploring new territory. Habitat use information and traditional use patterns are learned behaviors and are passed down through the generations.

Mountain goat populations in the Cabinet Mountains (both East and West Cabinets) are thought to be declining (Joslin 1980). Historic population numbers were estimated to be 305 goats in the East Cabinets in 1950 (Casebeer, Rognrud, and Brandborg 1950) declining to estimates of 56 to 78 in 1980 (Joslin 1980). Current populations are unknown (Jerry Brown, Department of Fish, Wildlife and Parks, personal communication, January 27, 1995), but it is thought that the trend is unstable.

Goats in the East Cabinets occur in three general concentrations, one of which is referred to as the Rock Peak herd. Key winter ranges and summer/transitional ranges for goats of the Cabinets were identified during a mountain goat study conducted by Joslin (1980) (see **Figure 3-17**). Goats of the Rock Peak herd are thought to use a key winter range up the East Fork of Rock Creek near Rock Creek Meadows. These goats are suspected to move up to 12 miles to summer/transitional ranges. This winter range, therefore, is important to numerous and far-ranging goats. Only a few important winter ranges were identified in Joslin's study. Key summer/transitional range, more abundant than winter range, extends along the Cabinet divide and associated ridges and basins (see **Figure 3-17**).

Some of the areas that goats have been observed include on or near Saint Paul, Rock, and Chicago peaks; Government Mountain; Cliff and Rock lakes; and on the east side of the Cabinets in the heads of Libby, Ramsey and west Fisher drainages (Farmer and Heath *In* ASARCO, Incorporated 1987-1994; J.Brown, pers. comm., November 18, 1993). Goat use of Saint Paul and Chicago peaks was much reduced during mineral explorations that occurred in the early- to mid-1980s. Current use is improved over that during the exploration period (J. Brown, pers. comm., January 27, 1995).

Goat dispersal patterns in the East Cabinets are not well understood. It is possible that goats observed in drainages on the east side of the Cabinets use habitat located on the west side, including the Rock Creek Meadows winter range. Locations of two important components of goat habitat, kidding grounds and mineral licks, are unknown.

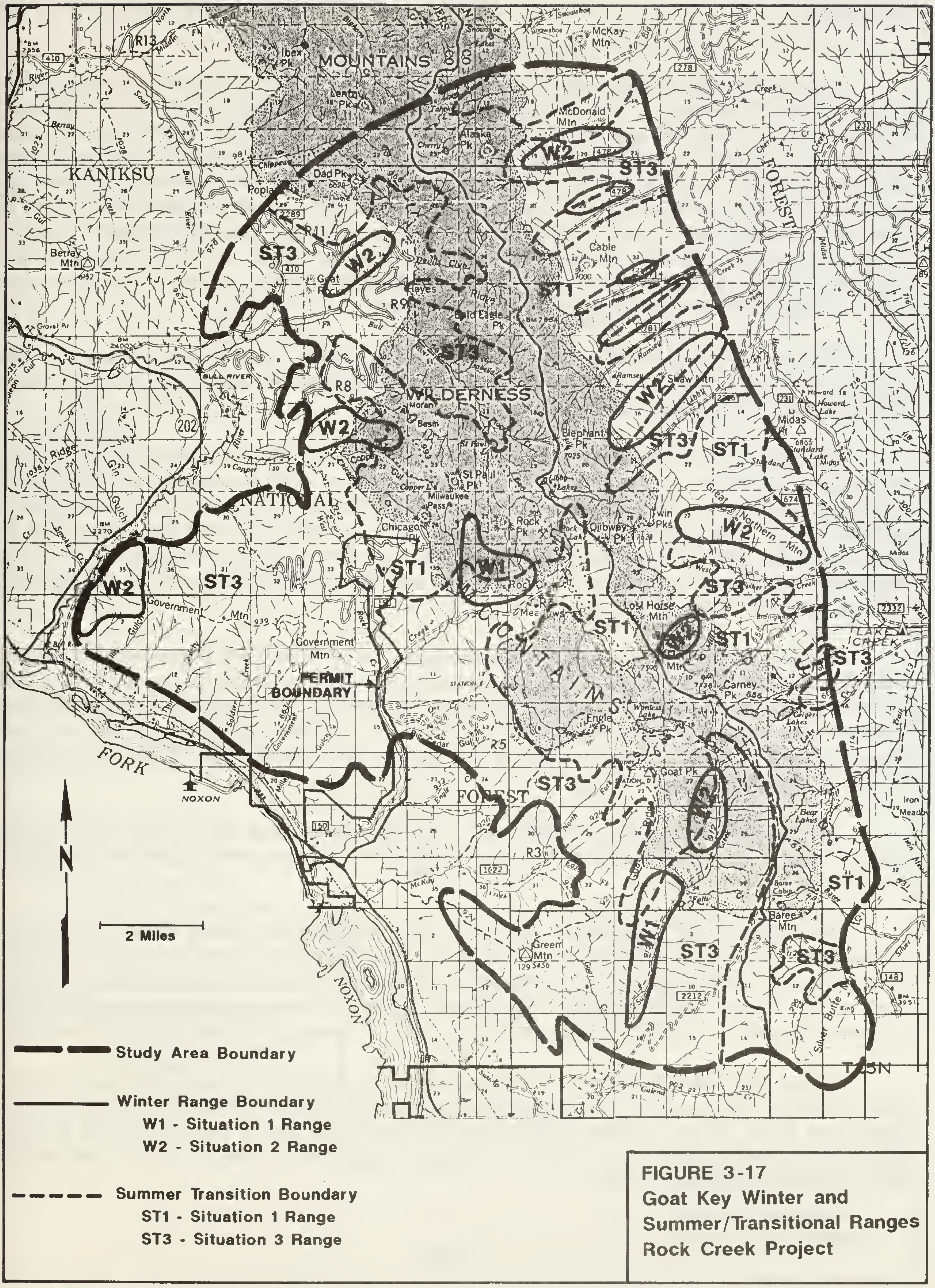

FIGURE 3-17
Goat Key Winter and Summer/Transitional Ranges
Rock Creek Project

Source: Joslin 1980.

As part of the mountain goat study, Joslin further classified winter and summer/transitional ranges as Management Situations 1, 2, or 3 and developed a goat management plan for the Cabinet Mountains (see **Figure 3-17**). Goat Management Situation 1 is defined as critical habitat with documented current or recent use by goats. Goat Management Situation 1 ranges are most sensitive to habitat manipulation and human activity. Activities in or near these areas should be avoided and if unavoidable should only occur for short durations (Joslin 1980). Goat Management Situation 2 ranges provide suitable habitat but have infrequent sightings of goats. Historic use may have occurred. Goat Management Situation 3 ranges are not considered important summer/transitional or winter ranges, per se, but because of their proximity to quality habitat are important by perhaps providing some travel corridors. Sightings of goats in Goat Management Situation 3 ranges are not uncommon.

The proposed project lies in close proximity to Rock Creek Meadow Goat Situation 1 winter range and lies within Goat Management Situation 1 summer/transitional range, and Goat Management Situation 3 range (see **Figure 3-17**).

Elk. Elk, a KNF indicator species for big game, use a diversity of habitats found within the proposed permit area and project vicinity. Use occurs year-round but is less during the winter. While calving occurs within the Rock Creek area, location of specific calving grounds is unknown. Surveys conducted in the Rock Creek area including Basin, Copper, and McKay creeks and Government and Green mountains, over a 9-year period by DFWP, show an average spring herd size of 114 elk, the majority being cows and calves (Bruce Sterling, Department of Fish, Wildlife & Parks, in a memo to Lisa Fairman, June 15, 1994).

Green Mountain/McKay Creek area and the Pillick Ridge area are elk winter ranges (see **Figure 3-18**) (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). Cows, calves, and young bulls primarily were observed using these areas. Older bulls tended to winter in small groups in areas found between Miller and lower Rock Creek; at the confluence of the West and East forks of Rock Creek; between lower Basin Creek and lower Copper Gulch; and below Chicago Peak (Farmer and Heath *In* ASARCO, Incorporated 1987-1994).

Potential elk summer range, comprised of MA 12 and additional lands, exists throughout the project vicinity, Open road density is currently at 0.96 miles per square mile, higher than biologically sound levels.

White-tailed Deer. White-tailed deer, also a KNF management indicator species for big game, frequently are observed in the proposed project area. White-tailed deer, generally found in lower elevations than mule deer, primarily occur south of or at lower elevations than the confluence of Rock and Engle creeks. Concentrations were observed between Miller Gulch and Rock Creek (see **Figure 3-18**) (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). A variety of habitats are used by these deer.

Winter distribution of white-tailed deer appears to be controlled by snow depth and elevation. Identified winter ranges occur in low elevation drainage bottoms (primarily below 2,500 feet) along the Clark Fork River Valley. Winter ranges have not been identified in the Rock Creek drainage. Populations of white-tailed deer are cyclic in nature. Populations in the early 1990s indicate that white-tailed deer may be at a high.

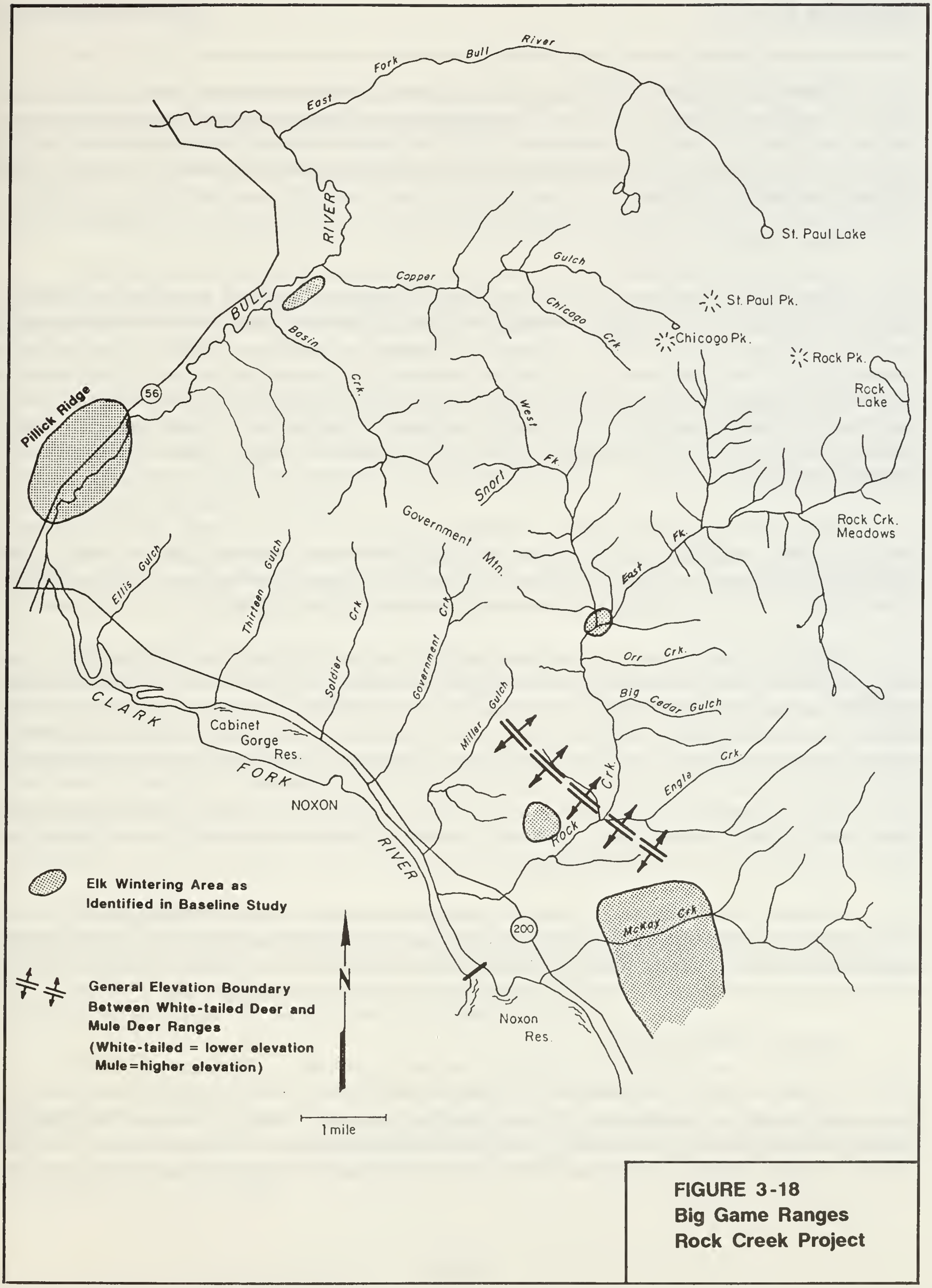

FIGURE 3-18
Big Game Ranges
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994.

Pileated Woodpeckers. Pileated woodpeckers are an indicator species for snags and old growth habitat. Population estimates for the Rock Creek area are unknown, as no surveys have been conducted. Farmer and Heath *In* ASARCO, Incorporated 1987-1994) identified one active nesting territory in Rock Creek and considered the woodpecker to commonly occur. Nesting habitat for the pileated woodpecker in Compartment 711 is limited.

Other Species of Interest

Black Bear. Black bears occur throughout the study area (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). Population densities are estimated to range from 2.8 to 8.6 square km. per bear (Kasworm and Manley 1988). Research by Kasworm and Manley (1988) indicates that the homeranges of at least five female black bears encompassed the proposed project area. Black bears use a diversity of habitats, often varying use by season. Shrubfields with high berry production, which are important fall foraging areas, are present within the proposed project area. Other important habitats present in the project area include riparian zones with lush vegetation, such as those along Rock Creek, and sidehill parks.

The proposed project falls within Hunting District (HD) 104. Prior to 1987, HD 104 was heavily hunted for bears, resulting in excessive bear mortality (Kasworm and Manley 1988). In 1988, DFWP implemented measures to reduce mortality; the bears are no longer overharvested (Harvey Nyberg, Department of Fish, Wildlife & Parks, personal communication, June 10, 1994).

Mule Deer. Mule deer are another commonly occurring big game species in the Rock Creek area. Mule deer occur in the project area during the summer primarily above the confluence of Engle and Rock creeks (see **Figure 3-18**) (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). Winter range is not thought to occur within the project area. Likely nearby wintering areas occur on south or west-facing slopes in Copper Gulch and McKay Creek. Population estimates or trends are not available.

Moose. Moose habitat is common in the project vicinity. While riparian habitats along Rock Creek provide quality habitat, the local moose population is thought to be low (Farmer, Farmer, and Heath *In* ASARCO, Incorporated 1987-1994).

Mountain Lion. Mountain lions occur throughout the project area. Current population numbers are unknown; however, hunting quotas were increased in 1991 and 1993, suggesting a possible increase in population numbers. During 1992, two lions were harvested from Rock Creek and during 1993, three were harvested from the general area (B. Sterling, pers. com. June 15, 1994).

Selected Wildlife Groups

Furbearers and Small Mammals. Furbearers, such as coyotes, bobcats, martens, weasels, minks, and otters all occur within the proposed project area and use a variety of habitats. No population estimates are available for these species. Martens are often associated with mature forests. Coyotes, bobcats, weasels, and small mammals, such as mice, shrews, and squirrels are found in the project area.

The small mammals are abundant. River otters and minks primarily use riparian and riverine habitats, such as those along Rock Creek and Clark Fork River.

Birds. Farmer and Heath *In* ASARCO, Incorporated 1987-1994) estimated that 159 bird species are likely to occur in the area. Species diversity and total bird numbers vary by habitat, the highest bird diversity occurred in coniferous forests, and the second highest occurred in water-associated habitats.

Many of the birds in the Rock Creek area are neotropical migrants (birds that summer in northern climates and migrate to Central or South America to winter). The general status of neotropical migrant populations in western U.S. forested areas is thought to be mostly stable (Terry McEneaney, Yellowstone National Park, personal communication, March 21, 1995).

Numerous raptor species nest and forage throughout the study area. Raptors thought to nest in the study area include great grey owl, northern goshawk, red-tailed hawk, sharp-shinned hawk, long-eared owl, and osprey (Farmer and Heath *In* ASARCO, Incorporated 1987-1994). Barred owls also are known to reside and may nest in the project area (Wayne Johnson, Kootenai National Forest, personal communication, February 22, 1995).

Two upland game birds commonly occur within the proposed project area. Ruffed grouse are abundant in low to mid-elevation riparian habitats, such as those adjacent to Rock Creek. Blue grouse, less common than ruffed grouse, occur in mid- to upper elevation habitats.

Amphibians and Reptiles. Ten species of amphibians are known to or may potentially occur in the study area. Two of these, the tailed frog and spotted frog, are candidates for listing under the Endangered Species Act. While declines of these species are noted elsewhere, they are considered common in suitable habitat in western Montana (Reichel and Flath 1995). Three species were identified during the baseline study: long-toed salamanders were found in a variety of habitats including the Cliff Lake area; tailed frogs commonly occurred in many streams, including Rock Creek; and leopard frogs occurred in wetlands, marshes, and areas around Cabinet Gorge Reservoir. Seven more species could potentially occur. These include the Pacific giant salamander, rough-skinned newt, Coeur d'Alene salamander, boreal toad, Pacific tree frog, spotted frog, and bull frog.

Eight species of reptiles are known to or may potentially occur in the study area. Five of these species were identified during the baseline study: painted turtles occurred in Cabinet Gorge Reservoir; northern alligator lizards were commonly found in coniferous forests; and rubber boas, western garter snake, and the common garter snake were found in a variety of habitats. Three more species that could potentially occur include the western skink, racer, and rattlesnake.

Population estimates for these amphibian and reptile species are not known. Global and regional populations indicate a downward trend of many species (Koch and Peterson 1989). The leopard frog, common in many parts of North America a few decades ago, is now suffering widespread extinctions. The sighting of leopard frogs during the baseline study may represent one of the last reports of the frog in westcentral and northwestern Montana (Jim Reichel, Montana Natural Heritage Program, personal communication, June 8, 1995).

THREATENED AND ENDANGERED SPECIES

Five federally listed species, under the Endangered Species Act (ESA) as amended, may use habitat in or near the proposed project site. They include the endangered bald eagle, peregrine falcon and gray wolf and the threatened grizzly bear and water howellia (Kemper McMaster, U.S. Fish and Wildlife Service, in a letter to Jim Mershon, January 25, 1994). Pursuant to Section 7 of the ESA, the Forest Service prepared a Biological Assessment for these listed species (see **Appendix B**).

Bald Eagle

The proposed project site lies within the Upper Columbia Bald Eagle Recovery Zone of Montana (U.S. Fish and Wildlife Service 1986). Bald eagles are residents in the Clark Fork River corridor. Over the past 10 years, sightings have varied from six to 38 eagles during a yearly 1-day January eagle count along the lower Clark Fork River from Thompson Falls to the Idaho state line. Farmer and Heath *In* ASARCO, Incorporated 1987-1994) reported a total of 16 sightings in their study area, and a maximum five-bird sighting in a single day. **Figure 3-19** shows historic bald eagle sightings. Winter use level depends on ice conditions on Noxon and Cabinet Gorge reservoirs. When the reservoirs freeze, the eagles leave.

Eagles winter along the entire length of the Clark Fork River as it flows across the Cabinet RD. Wintering habitat extends downstream to Lake Pend Oreille. Wintering habitat generally occurs within 1 mile of food sources (open water, big game winter ranges) and has adequate perch and sheltering roost trees (Montana Bald Eagle Working Group 1991). Wintering eagles have been observed feeding on dead deer along Montana Highway 200 within 0.5 mile of the proposed tailings impoundment. There are no suitable perch or shelter trees within the project area.

There are two bald eagle nests in the general area. One is about 3 air-miles south of the proposed Rock Creek tailings impoundment. The nest has been active since 1990 and has fledged young each year through 1993. The second nest was discovered in March, 1994, about 4 air-miles west of the project area. The nest was occupied by a pair in 1994.

Nesting habitat is described as the largest living trees in a multi-storied stand near a body of water. The body of water must support an adequate food base (U.S. Fish and Wildlife Service 1986). The nest trees provide an unobstructed view of foraging site(s). They have open crowns and sturdy limbs to support massive eagle nests. There are no suitable nest tree sites in the proposed project area.

Eagles forage for fish in the two reservoirs (Noxon and Cabinet Gorge) and the major tributary streams (Vermillion and Bull rivers). Eagles scavenge along the railroad tracks, FDR No. 150, and Montana Highway 200.

Trees suitable as hunting perches generally have an unobstructed view of the hunting area and are relatively close to it. There are no hunting perch sites within the project area because it is greater than 1 mile from Noxon Reservoir, the primary foraging area.

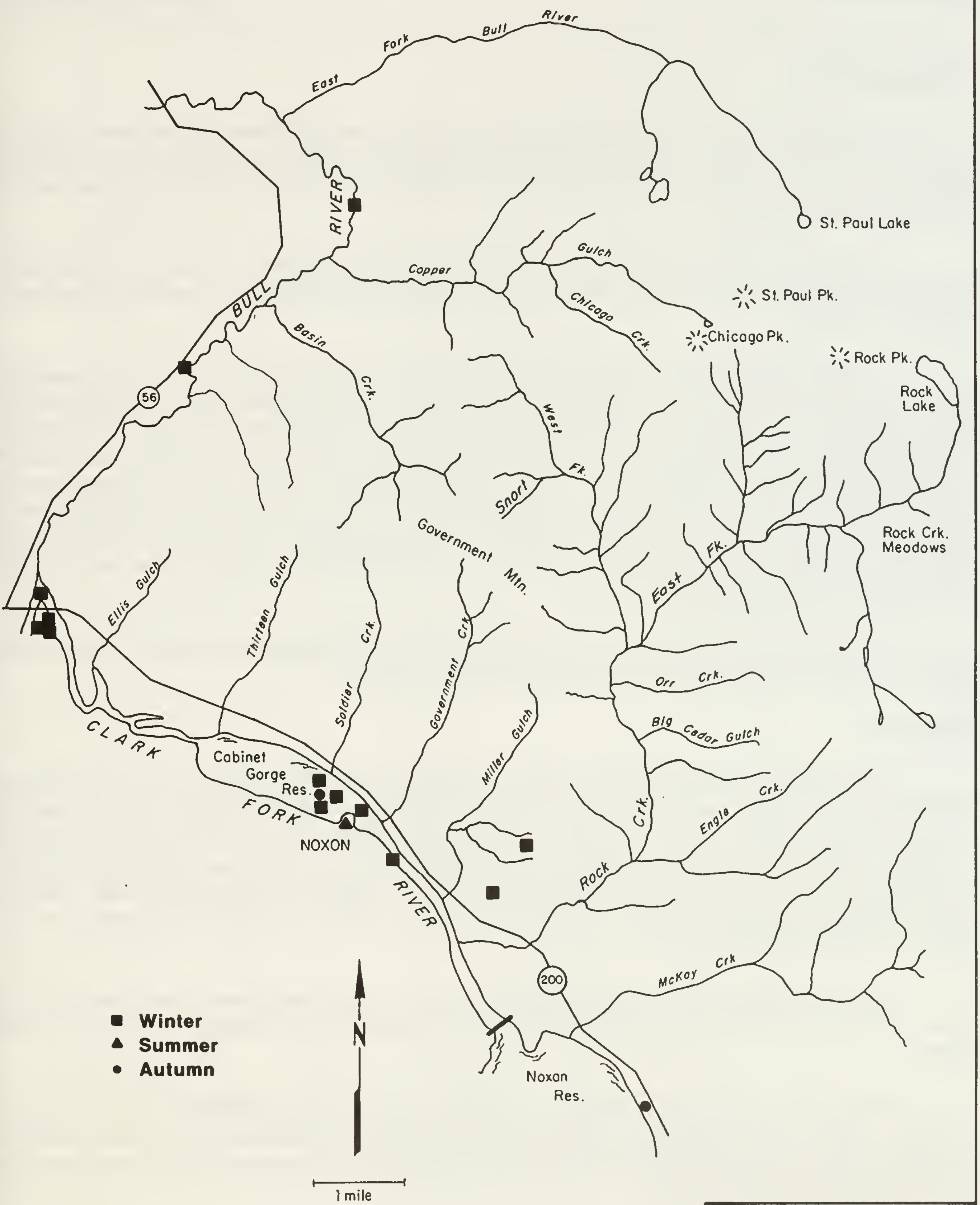

FIGURE 3-19
Bald Eagle Sightings
Rock Creek Project

Source: ASARCO, Incorporated 1987-1994
and Kootenai National Forest

Peregrine Falcon

The project area is part of the Rocky Mountain/Southwest population recovery zone (U.S. Fish and Wildlife Service 1984). The peregrine falcon is a possible migrant through the lower Clark Fork Valley. There is one confirmed sighting (1993) approximately 4 air-miles south of the proposed Rock Creek tailings impoundment.

A historic aerie (nest) is located just across the state line in Idaho. Attempts are being made to reintroduce peregrines at that site (Bob Summerfield, Kootenai National Forest, personal communication, October 12, 1993).

An important component of peregrine falcon habitat is the availability of tall cliffs (greater than 200 feet) for nesting (U.S. Fish and Wildlife Service 1984). The Peregrine Fund inventoried the Clark Fork drainage (including the Bull River) for such sites in 1989. They identified cliffs west of the Bull River as potential nesting habitat (Bob Summerfield, pers. comm., October 12, 1993). These cliffs are about 7 miles west of the project area. Hamer (1976) identified the cliffs on Ibex and Scotty peaks as possible nesting habitat. These sites are about 12 air miles north of the project area. Potential nesting habitat is also present on the cliffs near Tuscor Hill (4 air miles south). Marginal cliffs (less than 200 feet tall) are found on the south side of Government Mountain (1 mile west). There are no suitable nesting sites in the proposed project area.

An acceptable prey base (waterfowl and small birds) for peregrines exists on the Cabinet Gorge and Noxon reservoirs and the surrounding sloughs and wetlands.

Gray Wolf

The project area lies outside the Northern Rocky Mountain Wolf Recovery Area (U.S. Fish and Wildlife Service 1987). The area is about 16 air-miles east of a potential dispersal corridor that runs along the Montana-Idaho border. The gray wolf is a potential transient through the lower Clark Fork Valley. There are two unconfirmed sightings (1991) within 1 mile of the proposed Rock Creek tailings impoundment. There is a 1979 unconfirmed sighting within 1 mile of the proposed mill site. There are three unconfirmed reports of a pack (three animals) using the Pillick Ridge/Blue Creek areas, 7 to 15 air miles west of the project area.

An adequate prey base of elk and deer exists in the area to contribute to the support of a wolf pack. NFS lands in the project area downstream from Engle Creek are managed for big game winter range.

Den sites are generally greater than 1 mile from open roads or trails and 1 to 2 miles from campsites (1987). These sites are normally on southerly aspects, on moderate slopes, within 400 yards of surface water, and at an elevation overlooking surrounding low-lying areas. There are no known den sites in the Rock Creek drainage.

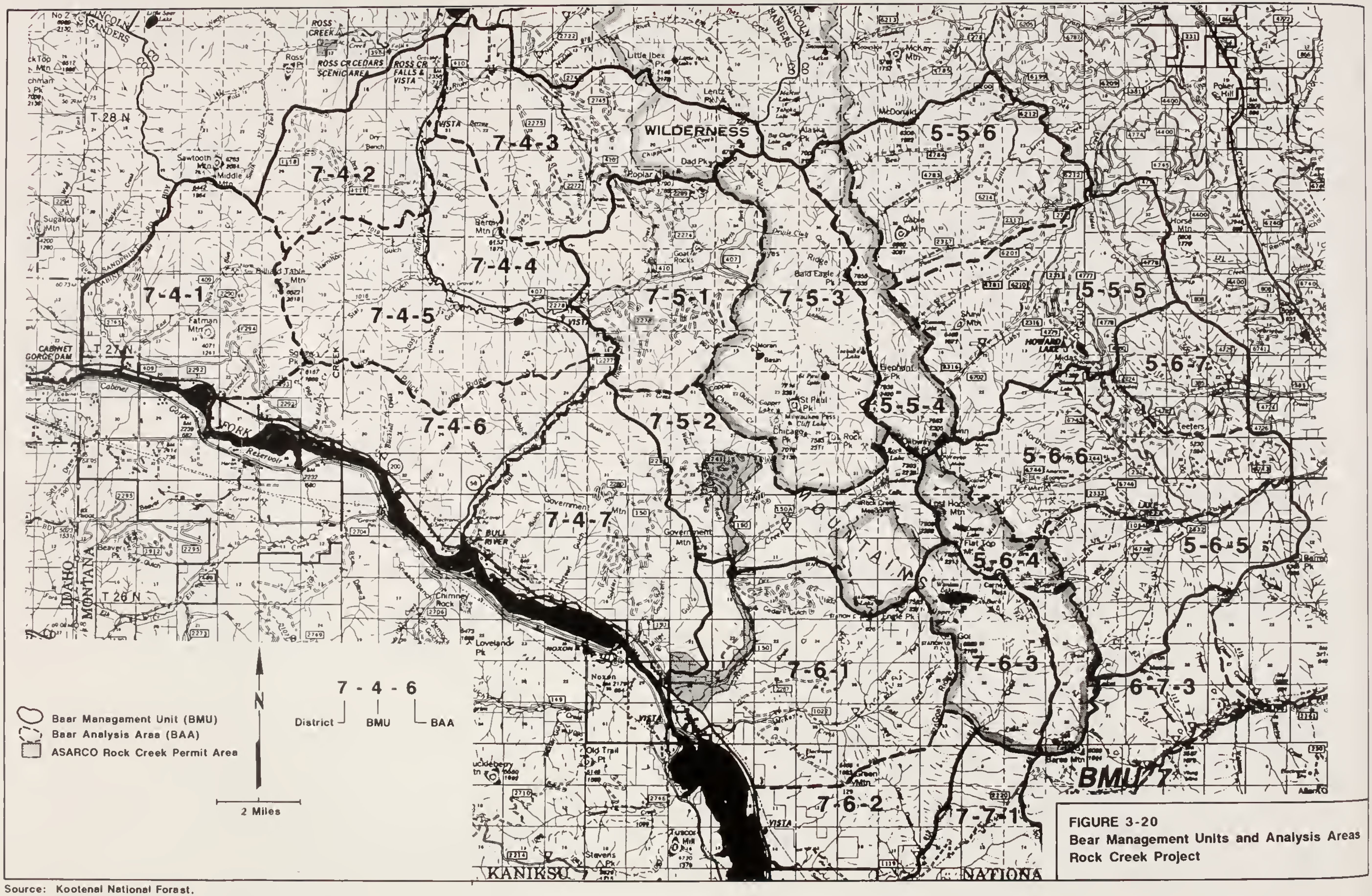

FIGURE 3-20
Bear Management Units and Analysis Areas
Rock Creek Project

Source: Kootenai National Forest.

Rendezvous sites, and resting and gathering areas, are usually complexes of meadows and adjacent timber, with surface water nearby (U.S. Fish and Wildlife Service 1987). They tend to be away from human activity. There are no known rendezvous sites in the Rock Creek drainage.

Another component of wolf habitat is sufficient space with minimal exposure to humans (U.S. Fish and Wildlife Service 1987). Space is discussed in the section on grizzly bear.

Grizzly Bear

The proposed project lies in the 2,600-square-mile Cabinet-Yaak ecosystem recovery zone (U.S. Fish and Wildlife Service 1993). The current population estimate for this ecosystem is 20 grizzly bears (Wayne Kasworm, U.S. Fish and Wildlife Service, personal communication, July 19, 1994). The present population is thought to be old-aged and on the decline (Kasworm and Manley 1988). There have been four young female grizzlies transplanted into the ecosystem from Canada over the past 5 years. One of these transplants has since died from apparent natural causes.

The analysis area for grizzly covers Bear Management Units (BMUs) 4 (Bull), 5 (Saint Paul), and 6 (Wanless) (only portions shown in **Figure 3-20**). Project activities would occur in Bear Analysis Areas (BAAs) 7-4-7, 7-5-2, 7-5-3 and 7-6-1 (see **Figure 3-20**). **Table 3-25** summarizes reports of grizzlies in these BAAs since 1960. BAAs are subunits of BMUs.

TABLE 3-25.
Grizzly Sighting Reports between 1960 and 1993

BAA	Visual Sitings (1960-1993)	Radio Locations (1983-1993)	Mortality (1975-1993)
7-4-7	8	1	0
7-5-2	7	6	1
7-5-3	8	21	0
7-6-1	4	7	0

Source: Cabinet Ranger District 1994.

Habitat components important to grizzly bear have been mapped for the proposed project area and are summarized in the Biological Assessment (see **Appendix B**). Habitats of particular importance to grizzlies include shrub fields, snow chutes, wet meadows, low-gradient stream bottoms and, in general, areas where preferred bear foods are abundant. Grizzlies select habitat types rich in herbaceous foods in spring and early summer. Late-summer and fall habitat is dominated by sites with abundant huckleberry fields. The Rock Creek drainage provides about the same proportion of key habitat types as other areas of the Cabinet Mountains.

Grizzly denning habitat is generally above elevation 5,200 feet and on north and west aspects in the Cabinet Mountains (Kasworm and Thier 1992). The Rock Creek drainage does contain potentially suitable denning habitat, but none in the proposed project area. There are no known den sites in the Rock Creek drainage.

A cumulative effects analysis process was developed for the Cabinet-Yaak ecosystem (U.S. Forest Service 1988). This process is referred to as the Cumulative Effects Model (CEM). The CEM looks at habitat conditions and all human activities that could displace bears or result in bear mortality. The details of this process are described in the *Cumulative Effects Analysis Process for the Cabinet-Yaak Grizzly Bear Ecosystems* (Ibid.) and are summarized in the Biological Assessment. Habitat effectiveness or percent of the area free from human disturbance is one of the elements of this model. Based on the CEM, existing habitat effectiveness of each BMU is: BMU 4 - 62.3 percent, BMU 5 - 73.9 percent, and BMU 6 - 70.8 percent. Only one unit is below the 70 percent threshold of undisturbed habitat needed in each bear unit (Christensen and Madel 1982).

The Kootenai Forest Plan establishes an open road density (ORD)[5] on areas managed for grizzly bear (Management Area 14) of 0.75 miles per square mile. This same objective applies to each BAA. **Table 3-26** displays the current situation for open road density.

TABLE 3-26.
Open Road Density (Miles per square mile) Summary

BAA	ORD
7-4-7	0.85
7-5-2	0.79
7-5-3	0.00
7-6-1	0.78

Source: Kootenai National Forest 1994.

Water Howellia

Surveys for this species were conducted concurrent with the sensitive plant surveys. No occurrences of this species were found (Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994; ASARCO, Incorporated 1990; ASARCO, Incorporated 1993; Montana Natural Heritage Program 1993 and 1994).

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[5] ORD is the miles of road open to public use per 640 acres, or one section of land expressed as miles per square mile.

Water howellia grows in firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows (Shelly and Moseley 1988). These wetland habitats are filled by spring rains and snowmelt runoff, and depending on temperature and precipitation, exhibit some drying during the growing season. This plant's microhabitats include shallow water, and the edges of deep ponds that are partially surrounded by deciduous trees (Shelly and Moseley 1988; Gamon 1992; U.S. Fish and Wildlife Service 1994). No suitable habitat exists in the planning area.

SOCIOECONOMICS

Local Employment and the Economy

The Sanders County economy has shifted from primary reliance on resource extraction to a predominance of services and trades. Services (such as business, health, financial and other) provide the largest sources of local employment followed by government employment; 25 percent and 18 percent, respectively (see **Figure 3-21**). Other sectors include manufacturing (17 percent), wholesale and retail trade (15 percent), forestry and mining (15 percent), and construction/transportation (10 percent).

Services, dividends, retirement income and transfer payments provide 55 percent of total Sanders County personal income (Bureau of Economic Analysis 1993). Government employment provides about 14 percent of all personal income. Other sectors provide lesser amounts: manufacturing (11 percent), construction/transportation (7 percent), forestry and mining (7 percent), and wholesale and retail trade (6 percent). (See **Figure 3-22**). Sanders County incomes averaged $28,800 per household in 1991 for a county total of $97,783,000. County wages and salaries totaled $35,292,000 in 1991, equivalent to $15,600 per worker, 19 percent below the average Montana worker (Bureau of Economic Analysis 1993).

The civilian labor force in Sanders County has grown from 2,870 workers in 1970 to 3,784 in 1994 (a 1.16 percent average annual increase). The period of greatest growth was in the late-1970s and early-1980s when the work force grew to over 4,500. The Sanders County work force rate of growth has been substantially less than statewide growth rates over the same period. The Sanders County labor force has varied substantially in recent years, from a low of 2,900 workers in 1993 to a high of 3,800 in 1994.

Over the past decade, the annual average Sanders County unemployment rate has been about 14 percent, double the Montana average of 7 percent over the same period. Lincoln county has experienced similarly high unemployment levels.

The three local counties (Sanders, Bonner, and Lincoln) can be described on a spectrum of economic and social factors. Sanders County described above has moved from a resource-extraction economy to a mixed economic base. Lincoln County is among the most resource-extraction-dependent counties in the region, having 20 percent of its jobs in wood products and 5 percent in mining (prior to the Troy Mine shutdown in 1993). Bonner County has a growing services, retirement, and recreation economy, with services providing 30 percent of county employment.

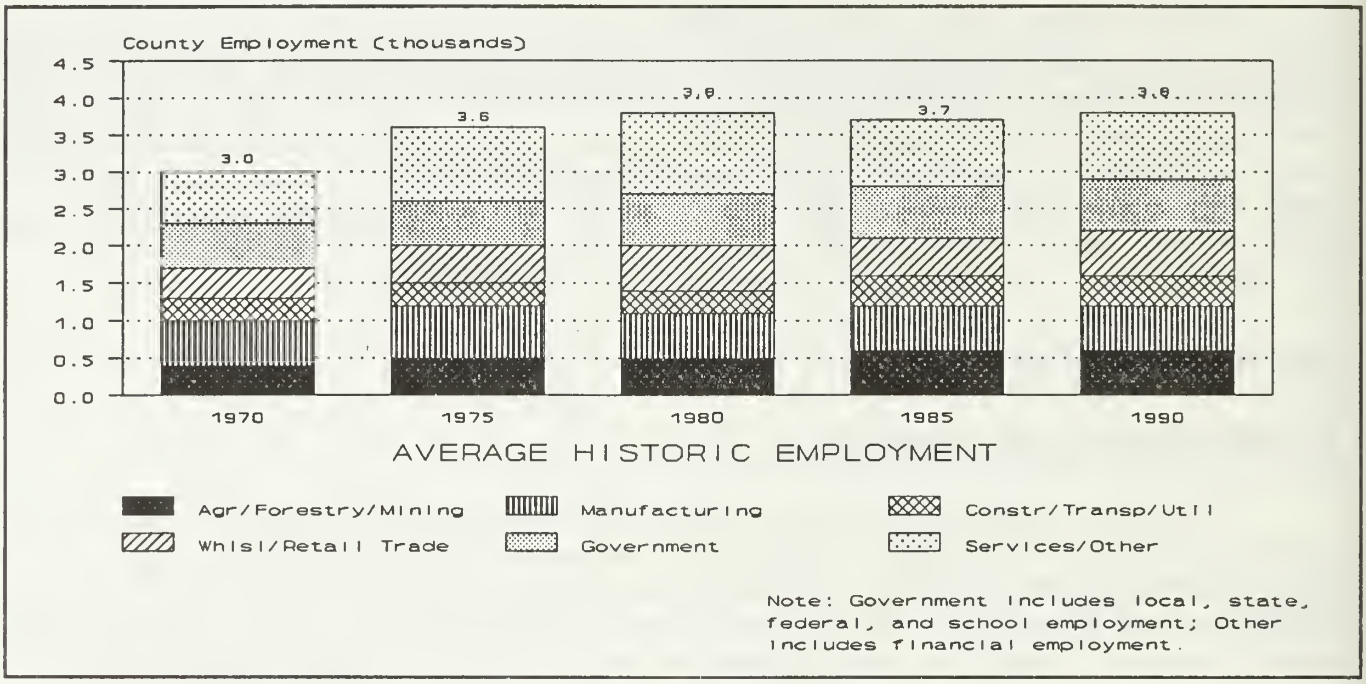


Figure 3-21. Sanders County Employment Trends

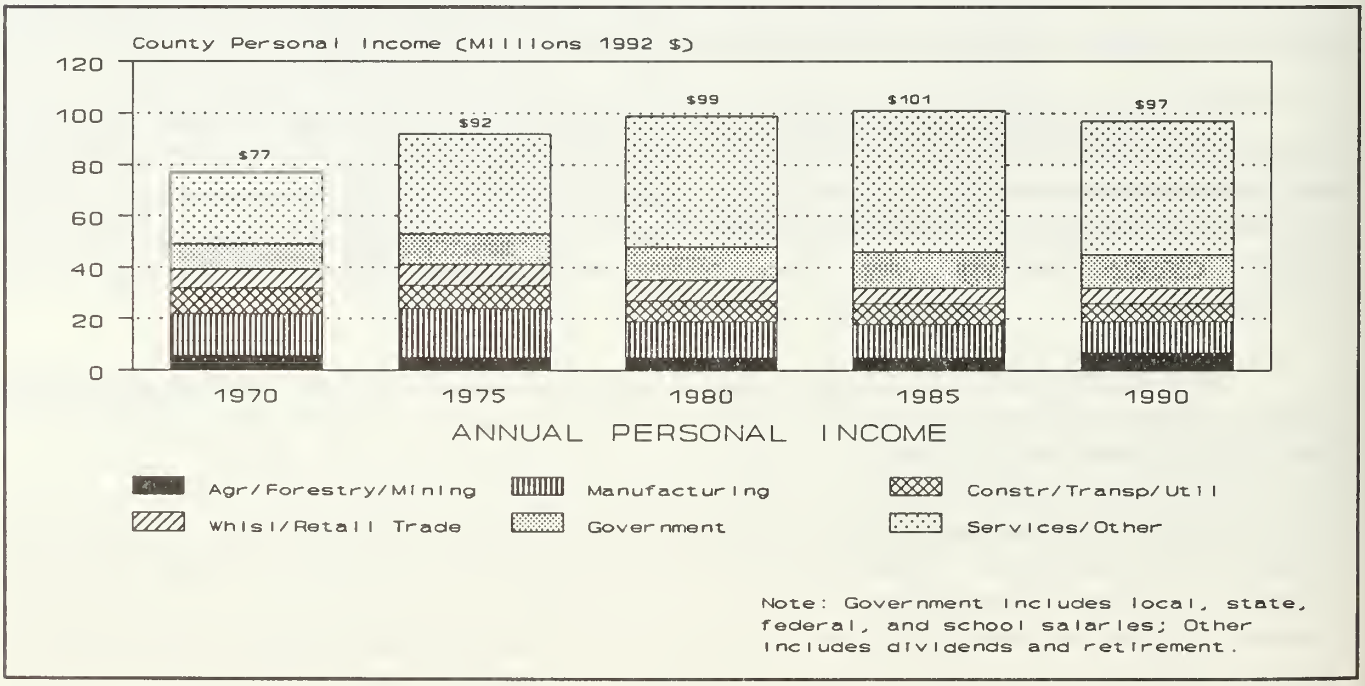


Figure 3-22. Sanders County Personal Income Trends

Population and Demographics

The population of Sanders County has increased by 2,750 persons in the last 44 years (an annual growth rate of 0.8 percent), from 6,983 persons in 1950 to 9,733 in 1994. The largest increase was during the 1970s when Sanders County grew by 1,582 persons as retirees seeking a rural setting and natural beauty moved into the county. Recent population has increased from 8,700 to 9,700 persons in the last 4 years. Sanders County's recent growth rates are significantly above statewide population growth patterns over the decade (U.S. Bureau of Census 1991, 1993, and 1995).

Community Services and Facilities

Schools

There are three elementary schools and two high schools in western Sanders County. The Noxon/Heron School District includes the Noxon Elementary and the Noxon High School. The Trout Creek School District has one elementary school whose students can attend either the Noxon or Thompson Falls high schools. The Thompson Falls School District includes elementary and high schools. **Table 3-27** lists these school district enrollments, and student/teacher ratios. Present student to teacher ratios range from 10:1 at Noxon High School to 19:1 in Trout Creek Elementary School. The Montana average student to teacher ratio is 15.8:1.

TABLE 3-27.
Current Enrollment and Student/Teacher Ratios

District and School	1993-1994 Enrollment	Student/Teacher Ratios
Noxon Elementary/Junior High	202	16:1
Noxon High School	122	9:1
Trout Creek Trout Cr. Elementary	106	18:1
Thompson Falls Thompson Falls Elementary/Junior High	434	17:1
Thompson Falls High School	234	18:1

Source: Office of Public Instruction 1993.

Law Enforcement

Montana Highway Patrol, Sanders County Sheriff's Department, and Thompson Falls Police Department provide law enforcement coverage in western Sanders County. The county sheriff is headquartered in Thompson Falls. Staff includes an undersheriff, five dispatchers, and three deputies patrolling western portions of the county. One deputy is stationed in Noxon. There is a new jail at Thompson Falls with a capacity of 35. Although staffed 24 hours per day, the average jail occupancy is very low (estimated three inmates).

The Thompson Falls Police Department employs two full-time police officers who work alternating 12-hour shifts. Emergency dispatch is handled by the sheriff's office. There is one Montana Highway Patrol officer stationed in Sanders County who patrols 115 miles of Montana Highway 200 from the Idaho line to Ravalli.

Fire Protection

Fire protection in western Sanders County is provided by the Noxon, Heron, Trout Creek, and Thompson Falls rural fire districts, the Thompson Falls Fire Department, DSL, and KNF. Noxon Rural Fire District is nearest to the project site. It has about 14 active volunteers and six inactive volunteers, operating out of a new three-stall fire station and a two-stall satellite station located at the junction of highways 56 and 200. It has mutual aid agreements with the Heron, Trout Creek, and Thompson Falls rural fire districts.

KNF is responsible for wildland fire protection of NFS and private lands within the study area.

Ambulance Services

There are two local ambulance services based in Noxon and Thompson Falls. The county levies a one mill property tax to help support these services. The Noxon ambulance provides 24-hour emergency service and is staffed by 16 volunteers. Two emergency vehicles and one boat are maintained by Noxon Ambulance. Thompson Falls Ambulance Service also provides 24-hour coverage with nine volunteers and one ambulance. Emergency air evacuation (air ambulance) is available from Missoula and Spokane.

Hospital and Physician Services

There are no local hospitals in western Sanders County. A branch of the Rittenour Clinic provides one visiting physician at the Thompson Falls clinic. Thompson Falls has a resident dentist, an optometrist, and a family physician. The nearest hospitals are Bonner General Hospital (62 beds) in Sandpoint (57 miles), Saint John's Hospital (29 beds) in Libby (61 miles) and Valley Clinic (24 beds) in Plains (65 miles).

Water Supplies

Noxon's water system consists of two wells, a storage tank, and a water main system serving about 250 connections. Water Service, Inc. provides water service to about 100 Trout Creek customers. Trout Creek's water system is generally adequate. Heron is served by two water systems--Heron Community Water Systems, Inc. and Heron Acres Water System. Heron Community water system provides water to about 40 customers within the town of Heron, while Heron Acres serves five homes outside Heron. Both water systems are in good condition, however the Heron Acres system is currently at capacity, thus requiring new Heron Acres residents to drill individual wells. Thompson Falls water system receives water from Ashley Creek and two wells. The water system is currently in fair shape and supplies about 600 connections. In western Sanders County, most residents outside the service area of Noxon, Heron, Trout Creek or Thompson Falls must rely on individual wells, springs, or haul water.

Sewage Treatment

Rural residents of western Sanders County use individual septic tank/drainfield systems for wastewater treatment and disposal. All new septic systems are evaluated by the county sanitarian to assure proper operation and health. Heavy clay soils in the western part of the county can constrain siting and proper operation of septic systems.

Thompson Falls is served by a three-cell aeration treatment system, with river discharge. This system serves the main street businesses and residences south of the railroad tracks and is operating near capacity. Waste treatment for the remainder of Thompson Falls is by individual septic systems.

Solid Waste Disposal

There is a countywide solid waste district but no licensed landfill in Sanders County. A combination of public and private refuse collection is provided throughout the county. Most trash is collected at trash-collection stations. One collection station is located immediately north of Montana Highway 200 near the FDR No. 150 junction. Collected refuse is hauled to Thompson Falls where it is compacted for shipment to a Missoula landfill.

Social Services

Social services are provided by the County Human Service office in Thompson Falls. Funding for these service comes from federal, state, and county sources. These services include: aid to families with dependent children, food stamps, general assistance, medicaid, low income energy assistance, and foster care/child neglect services. Mental health services are provided by the Region IV Community Mental Health Center, operating a branch office in Thompson Falls. Thompson Falls also has a local alcohol treatment program.

Libraries

The public library is located in Thompson Falls. Interest in library service has continued to grow in recent years.

Housing

1990 census data are the most recent, detailed information on housing characteristics. There are an estimated 4,300 housing units in Sanders County, including 960 in the Thompson Falls vicinity, and 1,250 in Sanders County west of Thompson Falls. Of the 2,210 units in western Sanders County, about

80 percent are occupied, either by renters (20 percent) or by owners (60 percent). The remaining 20 percent are occupied seasonally. There are few houses currently available for rent.

Sanders County has few restrictions on housing placement outside of Thompson Falls. All new construction must have a general waste water/sanitation permit from the county.

Fiscal Conditions

Local property taxes provide less than one-half of total revenues. Sanders County's total taxable property value was about $30 million in 1994. Sanders County per capita taxable value of $3,421 is 54 percent above the statewide average.

Sanders County annual operating budget has fluctuated in the same general range (about $3.9 million adjusted for inflation) for the past 5 years. In 1983 and 1993, the total annual budget was $3.8 million. The largest share of expenditures was for transportation (roads and bridges), followed by general government services (personnel such as commissioners, elected officials, and judicial services), public services (health and welfare) and public safety (law enforcement, ambulance). Property taxes made up 46 percent of total county revenues, a substantial increase from the 36 percent share in 1987 (see **Table 3-28**).

TABLE 3-28.
Sanders County Expenditures and Revenues

County Budget Report	Expenditures	Revenues
1991-92 Budget	$3,851,423	$4,339,116
1992-93 Budget	$3,981,279	$3,640,935

Source: Montana Department of Commerce 1994.

Thompson Falls' annual operating budget was $332,500 in 1993. Property taxes as a share of total revenue remained at a fairly constant 44 percent of the total revenues.

Table 3-29 shows the annual revenues and expenditures for the Noxon, Trout Creek, and Thompson Falls school districts.

TABLE 3-29.
Area School District Revenues and Expenditures for the 1993-94 School Year

District	Total Revenue	Total Expenditures	Total Students	Expenditures per Student
Noxon School District	$1,902,000	$1,851,000	326	$5,680
Trout Creek School District	$420,000	$403,000	106	$3,800
Thompson Falls School District	$3,000,000	$3,000,000	668	$4,490

Source: Montana Office of Public Instruction 1993; Noxon, Trout Creek, and Thompson Falls school districts 1995.

Land Use and Ownership

The western part of Sanders County has typical northwest Montana land use patterns, with human settlements along transportation routes in the valleys, surrounded by resource activities on public lands in the mountains. The primary valley land uses include transportation, utilities/hydroelectric dams, agriculture, logging and scattered residential areas. Montana Rail Link rail lines, the Noxon Rapids and Cabinet Gorge dams, and several utility pipelines and transmission lines are also located in the valley. Western Sanders County is a rural area, having no major population centers. Occasional small towns, such as Trout Creek, Noxon, Heron and Clark Fork are scattered along the Clark Fork River Valley, connected by Montana Highway 200. The largest town in the county, Thompson Falls (population 1,319), is located about 39 miles southeast of the proposed permit area.

The majority of land in the immediate vicinity of the proposed project area is managed by KNF for multiple land uses. The state manages a school section (Section 36, R32W, T26N) in the McKay Creek drainage to the southeast, and additional land in Section 26. The bulk of private lands are held by small landowners, although two timber companies have substantial holdings in the surrounding area; Plum Creek Timberlands and Idaho Pine. Private lands are managed for a variety of uses including timber harvesting, haying, recreation, and private residences, homesteads and businesses. There are an estimated 37 residences/businesses within 1 mile of the proposed project on the north side of the Clark Fork River. Most of these properties are located within 0.5 mile of Montana Highway 200. Lands immediately adjacent to ASARCO fee lands and mining claims include NFS lands, private timber holdings, and rural residential properties (see **Figure 2-7**).

TIMBER

Resources

The study area contains considerable timber resources (see **Table 3-30**). Total net volume of timber is estimated at 4,818 million board feet. Douglas-fir and lodgepole pine contribute the most volume to the total (26 and 24 percent, respectively). They are also the most productive on a per-acre

TABLE 3-30.
Characteristics of Timber in Rock Creek Study Area

	Parameter >7" Diameter Number/Acre	Net Volume/ Acre[1]	Total Net Volume[2]	Average Height	<4" Diameter Number/Acre
Hemlock	8.7	566	447	66	525
Red Cedar	28.6	857	677	53	--[3]
Grand fir	8.7	215	170	56	868
Douglas-fir	25.4	1610	1272	66	391
Larch	18.2 (<10)	800	632	78	0
White pine	1.2 (<10)	141	141	66	109
Ponderosa pine	8.7	273	216	78	11
Lodgepole pine	45.0 (<10)	1483	1171	66	391
Engelmann spruce	0.1 (<10)	36	28	115	18
Cottonwood	0.1	37	29	81	614
Mountain hemlock	(80)				(300)
Subalpine fir	(80)				(500)
TOTAL	136.4	6099	4818	65[4]	2870

Source: Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994; information in ( ) is estimated and refers to the Exploration Adit area, ASARCO, Incorporated 1992; no timber inventory data were gathered.

Note:
[1] Board feet.
[2] Million board feet.
[3] Probably included with the hemlock count.
[4] Overall average for original permit area.

basis. The density of trees 4 inches or less in diameter indicates regeneration rate. This rate is highest for grand fir, followed by western redcedar, western hemlock, Douglas-fir, and lodgepole pine.

KNF forest stands in the lower Rock Creek drainage average rate of growth is 532 board feet per acre per year. Standing volumes average 12,800 board feet per acre. The average growth rate on private lands in the area is 640 board feet per acre per year. The Cabinet RD provides about 2 million board feet for sale annually for this drainage, with private lands providing up to 4 million board feet annually. Because these private lands have been cut in excess of their growth rates, the rate of timber cutting from private lands is expected to decline sharply. Similarly, the timber cut from NFS lands in the Rock Creek drainage is expected to gradually decline over the next decade.

TRANSPORTATION

Major highways in the transportation study area include Montana highways 200 and 56, and U.S. Highway 2. In Sanders County, Montana Highway 200 is the primary transportation route and would be used by ASARCO employees, service vehicles, and vendors. Montana Highway 56 and U.S. Highway 2 would be used by mine-related traffic coming from Lincoln County. **Table 3-31** shows average daily traffic (ADT) counts and traffic accident data for 1987 for the segments of these highways that would handle project-related traffic.

TABLE 3-31.
Average Daily Traffic (ADT) Count[2] and Accident Data for Relevant Road Segments

Road Segment	ADT[1]			Accident Data[3]			
	1987	1992	1993	Fatal	Injury	Total	Rate[4]
U.S. 2 Libby to MT 56 (15 Miles)	2147	2587	2783	3	23	53	1.03
MT 200 Plains to MT 56 (64 Miles)	2048	2393	2487	2	17	27	1.79
MT 56 MT 200 to U.S. 2 (34 Miles)	708	824	972	1	22	49	2.14

Source: 1987 Data, Don Cromer, Montana Department of Highways, personal communication with Art Compton, July 15, 1988; 1992 Data, Dennis Hult and Dan Martin, Montana Department of Transportation, personal communication, October 19, 1993.

Note:
[1] Average daily traffic or number of vehicles
[2] Counter - US2 at Jct. w/MT Highway 56, MT Highway 200 at Jct. w/MT?
[3] Accident Data 6/86 to 12/87
[4] State average 2.02

Employees and vendors residing in Lincoln County would use U.S. Highway 2 and Montana Highway 56 to access the proposed project site. U.S. Highway 2 is a double-lane, paved highway running east to west across the state. It is currently in poor condition. U.S. Highway 2 has been reconstructed between Troy and Libby. Montana Highway 56 is a double-lane, paved highway running north and south between U.S. Highway 2 and Montana Highway 200. The state has resurfaced Montana Highway 56 from U.S. Highway 2 to the Lincoln-Sanders county line. The Bull Lake South Project, from Sanders-Lincoln county line to Montana Highway 200, is scheduled in 1998. (Bob Lajoie, Montana Department of Transportation, personal communication, October 19, 1993). The bridge connecting Noxon with Montana Highway 200 corridor is a single-lane structure. Vehicles must wait before entering the bridge when oncoming traffic approaches.

FDR No. 150, a single-lane, native surface road, connects the proposed project site with Montana Highway 200. It also forms a loop system over Government Mountain that is a popular recreational road. Traffic counts were made in 1984-1989 and in 1993 (see **Table 3-32**).

TABLE 3-32.
ADT Counts on FDR No. 150

Time Period	Site #1	Site #2
May - November 1984	25	4
May - November 1985	39	4
July - November 1986	31	10
June - November 1987	32	10
April - October 1988	42	
June - October 1988		14
July - November 1989	39	
September - October 1993	27	

Source: U.S. Forest Service, West Zone Engineering, Traffic Count Records
Notes: Site #1 - 4.5 miles up FDR No. 150 from Highway 200.
Site #2 - 100 feet past Snort Creek on FDR No. 150.
No additional roads within the project area have any traffic count records.

The Forest Service uses four traffic service levels; A, B, C, D. The Traffic Service Level (TSL) is determined by nine different characteristics; including traffic flow, volumes, vehicle types, critical vehicle, safety, traffic management, user costs, alignment and road surface. The TSL for all FDRs listed below is D and all have dirt surface (see **Table 3-33**).

TABLE 3-33.
Forest Development Roads - Lengths and Maintenance Levels

Number	Mileage	Maintenance Level[1]
150	25	2
150A	4.2	2
2741	6.8	2
1022	4.0	2
2210	4.2	1

[1] Maintenance Level; 5 maintenance levels - 1 = being closed to vehicles, 2 = dirt surfaced for high clearance vehicles, 3, 4, and 5 = gravel to paved surface for passenger type vehicles.

The maintenance level for FDR No. 150 is level 2 (see **Table 3-33**). This maintenance level is assigned where management direction requires the road to be open and maintained for safe travel by high clearance vehicles. Traffic volumes are minor to moderate; however, user comfort and convenience are not considered a priority.

There are two treated-timber bridges on FDR No. 150; one at milepost 2.3 and one at milepost 5.0. The bridge at milepost 2.3 has weight limits of 26 tons gross vehicle weight (GVW) for three-axle vehicles and 40 tons GVW for five-axle vehicles. The bridge at milepost 5.0 has a weight limit of 43 GVW for three-axle vehicles and 67 tons GVW for five-axle vehicles.

The nearest commercial airports are in Missoula and Kalispell, Montana. Thompson Falls, Plains, Libby, and Troy, Montana, have airports for general aviation. Burlington Northern, Montana Rail Link (MRL), United Parcel Service, and several carriers provide freight transportation. AMTRAK maintains a passenger depot in Libby. Currently, there is no public bus transportation between the cities and towns listed above. There is bus service only to Missoula and Kalispell in this general area.

Existing railroad track is being operated by MRL under lease from Burlington Northern. About 20 trains travel the local track daily, with one Plains to Sandpoint daily return. Hereford Siding is now used for temporary maintenance storage.

RECREATION

NFS lands make up over 50 percent of the Sanders County land base, and offer public access for a variety of motorized and nonmotorized recreational activities. The primary recreational activities in Sanders County, and in particular the Cabinet RD, are hunting, fishing, hiking, camping, boating, horseback riding, huckleberry gathering, firewood cutting, and recreational driving. Commercial outfitting provides services for about 5 percent of the recreation use on the Cabinet RD.

Boundaries of the Cabinet RD coincide in large part with DFWP elk and deer Hunting District 121 (HD 121) and black bear hunting district HD 104. Each year the DFWP conducts a statewide harvest survey to determine hunter activity throughout the state. **Table 3-34** gives information for deer and elk obtained from those surveys for HD 121. Many other species, including black bear, sheep, goats, moose, and grouse are hunted as well.

Some trapping occurs on the Cabinet RD with trapper numbers varying yearly, depending on fur prices. In general, the number of trappers appear to be relatively low, with only occasional trapping occurring in the Rock Creek drainage. Trapping may be limited to some extent by poor winter access.

TABLE 3-34.
Hunter Activity in Hunting District 121

Year	Resident Hunters	Resident Hunting Days	Nonresident Hunters	Nonresident Hunting Days
ELK				
1990	2,306	16,535	606	4,148
1991	2,485	16,505	606	3,856
1992	2,503	17,194	683	4,562
WHITE-TAILED AND MULE DEER				
Year	Resident Hunters	Resident Hunting Days	Nonresident Hunters	Nonresident Hunting Days
1990	2,800	20,550	753	4,973
1991	3,768	23,494	762	4,991
1992	3,270	22,614	895	5,544

Source: Montana Department of Fish, Wildlife and Parks 1990-1992.

Recreational fishing occurs throughout the planning area. The Cabinet Gorge and Noxon reservoirs provide both cold- and warm-water fisheries. Noxon Reservoir continues to see yearly increases in fishing pressure. Angler days per year on Noxon Reservoir were estimated at about 3,000 in 1989, 4,300 in 1991, and 6,300 in 1993 (Montana Department of Fish, Wildlife and Parks 1989, 1991, and 1993). Bass-fishing tournaments are now held three to four times a year on Noxon Reservoir, and include local, regional, and state tournaments. Rock Creek to some extent receives limited recreational fishing use. It is used by local anglers, with most use occurring on the East Fork of Rock Creek or at the ponds in Rock Creek Meadows. Other local streams and lakes within the area receive low-to-moderate levels of fishing pressure. Rock Lake is the closest wilderness lake to the project area, providing fishing opportunities for local residents and visitors.

There are about 50,000 recreation use visitor days per year on the Cabinet RD, discounting recreational travel along the major highways through the district. A vehicle survey in 1985 was used to estimate that about 1,600 recreational use visitor days occurred in the Rock Creek drainage. The most common recreational activities in that area were driving for pleasure/viewing the scenery, hunting, hiking, and berry picking.

Rock Creek drainage offers three recreational settings as defined by the Recreational Opportunity Spectrum (ROS). The settings are based on the environment, activities, and opportunities for obtaining experiences within the area. The settings within the Rock Creek drainage include 1) Roaded Natural areas within a mile-wide corridor along all roads within the drainage, 2) Semi-Primitive Nonmotorized areas 0.5 to 3 miles from any road with motorized vehicle use, and 3) Primitive areas within the CMW.

The CMW offers opportunities for primitive recreational activities in a pristine setting. The wilderness is split between Sanders and Lincoln counties. Access from the Lincoln County side is provided by 12 maintained trails and 19 trails that are not regularly maintained. Access from the Sanders County side is provided by nine maintained trails and six trails not regularly maintained. Access to the wilderness from the Rock Creek drainage includes Rock Creek Trail No. 935 from the East Fork Rock Creek Road and Engle Peak Trail No. 932 from Orr Creek Road. There is another access point at the end of Chicago Peak Road that is not currently maintained by the Forest Service but is a popular route to Milwaukee Pass and Saint Paul and Chicago peaks.

In 1993, about 22,500 recreation use visitor days were reported in the wilderness. About 7,800 of these use days were reported from the Sanders County side (Cabinet RD). This does not include that use which may be occurring at unmanaged access sites such as the Chicago Peak portal at the upper end of the Rock Creek drainage. It is estimated that at least another 300 recreation use visitor days can be attributed to unmanaged access sites. Hiking is the most popular activity in the wilderness. Fishing, photography, and hunting are the next most common activities pursued by wilderness visitors.

WILDERNESS

The CMW is a 94,272 acre unit of the National Wilderness Preservation System. It is about 34 miles long and varies from 0.5 to 7 miles wide. The wilderness occupies the upper elevations of the east ridge of the Cabinet Mountains, with elevations from 2,500 to 8,700 feet. The Cabinet Mountains are a north/northwest trending extensively glaciated mountain range. This glaciation has produced spectacular features such as high craggy peaks, vertical cliffs, knife edge ridges, amphitheater-like basins, and filled valley bottoms. These land-building processes have also created many streams and about 85 lakes within the wilderness.

Vegetation in the wilderness is abundant and varied, ranging from delicate harebells growing in rock fissures to the lush, valley bottom stands of old growth cedar and hemlock. Thirteen species of conifer trees, 130 species of wildflowers, and numerous shrub species are known to grow in the wilderness.

Numerous wildlife species inhabit the area within and adjacent to the wilderness. These include, but are not limited to, grizzly bear and black bear, elk, big horn sheep, mountain goats, mule deer, white-tailed deer, and many small mammals and birds.

The management of this wilderness is shared by three ranger districts of the KNF. To determine the type and extent of management actions appropriate for different portions of the wilderness, the Forest Service has identified two distinct opportunity classes. The opportunity classes are delineated according to the biological and social setting.

Opportunity Class I includes pristine areas of the wilderness that are without recreation trails. There may be game trails or other obvious ways or routes which have light use by backpackers but almost no stock use. There are many remote basins and valleys without fishable lakes. There is abundant opportunity for solitude. Little evidence of recreational use exists.

Opportunity Class II includes a delineation of trail corridors and more heavily used lake basins. Most lakes in this class are stocked with fish and have relatively easy access. The lake basins and the trail corridors accessing them total less than 15 percent of the wilderness acres but account for most of the recreation use. Heavily used lakes in the Rock Creek area include Wanless, Rock, Engle, and Saint Paul. Campsites in Class II have developed from repeated visitor use of the same place. These are often in poor locations, impacting both the biological and social environment. A typical lake basin in the wilderness has two to five recognizable campsites. Use patterns and activities have resulted in eroding trails, bare compacted soils, damaged vegetation, campfire remnants, litter, and sanitation problems. Management emphasis is on rehabilitation of overused areas, obliteration of unacceptable sites, information dissemination, and education of wilderness users to prevent further degradation (Kootenai Forest Plan 1987).

CULTURAL RESOURCES

Cultural resources are tangible remains of past human activity within the landscape. Cultural resources are identified and defined as geographic units or "sites" where past human activity occurred and evidence of past use can be documented. Generally, any site of human activity older than 50 years is considered to be a potential cultural resource.

Cultural Resource Surveys

Six cultural resource surveys have been conducted in the proposed project area (see **Table 3-35**). The past surveys include small, intensive surface ground surveys for small proposed developments such as roads, wells, and disposal and drill sites (Wilson 1990; Wilson 1992; Fredlund and Fredlund 1990; White 1990); an intensive cultural resource survey within the boundary of the proposed project area (Alternative II) (Caywood 1986); and a subsurface archaeological site discovery survey on landform areas in the project area that have high potential for the presence of buried archaeological deposits (Schwab and Aaberg 1994).

A total of eight cultural resource sites were documented during three of the six surveys (Caywood 1986; Fredlund and Fredlund 1990; and Aaberg and Schwab 1994). All eight sites are historic resources related to mining, logging, and homesteading activities during the late-1800s to about 1940 (see **Table 3-36**). All eight sites have been determined by the State Historic Preservation Office (SHPO) as ineligible for nomination to the National Register of Historic Places. Despite comprehensive surface and subsurface investigations, no prehistoric cultural resources have been recorded within the surveyed areas.

TABLE 3-35.
List of Previous Cultural Resource Class III Surveys Rock Creek Study Area

Project	Acres	Number Sites Recorded	Location
East Fork Rock Creek Road	15	1	Portions Sec. 2,10,11; T26N-R32W
Rock Creek Monitoring Wells	2	0	Portions Sec. 22,27,33; T26N-R32W
ASARCO LAD Sites	530	0	Portions Sec. 28,22,27, 33,32; T26N-R32W
McKay Road and Proposed Drilling	5	0	Portions Sec. 27; T26N-R32W
ASARCO Rock Creek Project	1200	5	Portions Sec. 3,10,15,21, 22,27,28,33; T26N-R32W Portions Sec. 33,34; T27N-R32W
ASARCO Rock Creek Mine Project Subsurface Cultural Resource Site Discovery Survey	320	0	Portions Sec.10,28,29,33; T26N-R32W

Source: Caywood 1986; Hydrometrics 1990; Aaberg and Schwab 1994.

TABLE 3-36.
List of Cultural Resources Recorded in the Rock Creek Study Area

Site Number	Site Type	Primary Period of Use
24SA169	Historic Homestead	1907 - 1917
24SA170	Historic Mining Pits	Undetermined
24SA171	Homestead-Logging	1906 - 1927
24SA172	Homestead-Logging	1906 - 1935
24SA173	Historic Homestead[1]	1917 - 1930
24SA328	Heidelberg Mine Road	ca. 1920 - 1937
24SA369	Historic Logging	ca. 1900 - 1940
24SA370	Historic Logging	ca. 1900 - 1940

Source: Caywood 1986.

[1] ASARCO burned the structures on this homestead in Spring, 1994.

NATIVE AMERICAN TREATY RIGHTS

Native American treaty rights include economic use areas important to modern Native Americans in the expression and practice of traditional culture values. These traditional resources often have a long history of use, and are associated with beliefs, customs, and practices of modern communities. Oral histories documenting the roles of these resources in traditional cultural values have often been passed down through generations. These traditional resources play a continuing role in tribal identities and sense of community. Native American resources do not always display physical evidence of past human use since many activities of traditional cultural expression leave no observable impact on the natural environment.

Native American resources and religious practices are protected by a number of federal laws, including the American Indian Religious Freedom Act (AIRFA), the Native American Graves Protection Act of 1990 (NAGPRA), and the National Historic Preservation Act (NHPA). Federal guidelines direct federal agencies to consult with modern Native American tribal representatives and traditionalists who may have concerns about federal actions that may affect religious practices or other traditional cultural uses.

The same criteria for NRHP eligibility presented earlier apply to Native American resources under NHPA. Federal actions that interfere with the practice of Native American religion are reviewed under AIRFA, and procurement and management of human skeletal remains and cultural remains associated with burials are considered under NAGPRA.

Historically, members of the Pend d'Oreilles (or Kalispel) Tribe were the primary aboriginal inhabitants of the Clark Fork Valley in the vicinity of the proposed Rock Creek Project (Teit 1930; Malouf 1982). Other groups such as the Flathead and Kootenai also frequented the Clark Fork Valley during historical times. All three tribes have had a long-term presence in western Montana. The Pend d' Oreille and Flathead share a common language family and several cultural and historical elements. The Kootenai have a distinct language and cultural history. All three tribal groups currently reside on the Flathead Indian Reservation east of the Rock Creek Project area.

The project area is located within lands encompassed by the Hellgate Treaty of 1855. The treaty was signed between the United States and the Flathead Nation; the Confederated Tribes of the Flathead, Kootenai, and Upper Pend d'Oreilles Indians (also known as the Kalispel Indians). The Flathead Nation is now known as the Confederated Salish and Kootenai Tribes.

The Hellgate Treaty encompassed about 28,000 square miles. Within this area, the Indians retained certain rights. These included hunting, fishing, gathering, and grazing rights as well as rights of passage. As a result, public agencies must consider treaty rights for actions proposed on public lands.

The KNF has established consultation with the Flathead Culture Committee (Flathead and Pend d' Oreille) and the Kootenai Culture Committee of the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation. The two culture committees have been designated by the tribal council to represent tribal interests in cultural resource issues. Although locations of traditional cultural value have been identified in the Cabinet Mountains outside the proposed project area, none of these sites have yet been identified in the area of proposed development. Traditional resources that have been identified by the Tribes include fish, medicinal and sacred herbs, grizzly bears, and huckleberries and other foods (Confederated Salish and Kootenai Tribes, in a memo to Connie Reid, August 19, 1994). Occupation sites are also considered a traditional resource.

SOUND

Sound levels are measured in decibels, generally using the A scale (dBA). The dBA scale begins at zero--the sound intensity at which sound becomes audible to a young person with normal hearing. Each 10 dBA increase in sound approximates a doubling in loudness, so that 60 dBA is twice as loud as 50 dBA. People generally have difficulty detecting sound level differences of 3 dBA or less.

An undesired sound (noise) can begin to degrade the sound environment at 35 dBA (daytime), the lowest level at which impacts on humans and animals normally occur (National Academy of Sciences 1979). The Environmental Protection Agency (1974) uses 55 dBA as a guideline at which human health and welfare becomes adversely affected. This guideline is lowered to 45 dBA at night to account for quieter night-time background sound levels and because of social expectations regarding sleep interference (Stolen 1980). The negative effects of noise are a function of existing sound levels, desired sound levels, and characteristics of added sounds.

Rock Creek Area

Rock Creek sound measurements indicate the area has low sound levels characteristic of rural areas and wilderness lands (Parker 1987) (see **Table 3-37**). These sound levels are affected primarily by wind, water, and ground cover conditions. During low wind conditions measured sound levels in the upper Rock Creek drainage were equivalent to ambient sound levels in typical wildland settings (Environmental Protection Agency 1979). The effects of human sounds (highway traffic and logging) are low and normally less noticeable. These sounds decrease with distance, and with intervening terrain and/or vegetation. Sounds are also influenced by wind direction.

TABLE 3-37.
Ambient Rock Creek Area Daytime Sound Levels[1] (in dBA)[2]

Cabinet Mountains Wilderness boundary	25 to 27
Cabinet Mountains Wilderness (15 MPH wind conditions)	38 to 47
FDR No. 150 (sound levels with traffic [3])	50
Highway 200 (sound levels with highway traffic [3])	70
Snort Creek/Chicago Peak Road (FDR No. 2741) above upper mill site	29 to 32
West Fork Rock Creek, at creekside near upper plant site	37 to 45
Noxon townsite [4]	45

Source: generally adapted from Parker 1987.
Notes: [1] Except as noted, measurements from Parker, 1987 as measured in calm and near calm conditions.
[2] dBA = decibels in the A scale; a measure of sound.
[3] Based on U.S. Bureau of Land Management 1986. [4] Based on National Academy of Sciences 1977.

SCENIC RESOURCES

Past and present land use has modified the predominantly natural appearing landscape in some parts of the study area. Most of the modification has occurred in major river valleys such as the Clark Fork Valley, where small towns, scattered residences, hydropower development, and major transportation routes combine to create a rural, semi-developed setting. In contrast, NFS lands adjacent to the Clark Fork Valley are largely undeveloped, with roads and logged areas creating the major modifications. Where logging activity has removed dense forest growth, unnatural-appearing open clearings provide the most noticeable landscape change until revegetation occurs.

KNF manages visual resources according to visual quality objectives (VQOs) developed through the Visual Management System (VMS) (U.S. Forest Service 1974), and further specified in the Forest Plan (1987). The VMS was developed to inventory the visual resource on all lands, whether public or private, and provide measurable VQOs for its management. The Forest Plan also designates minimum VQOs for each management area of NFS lands.

A visual resource inventory of the project area was conducted in 1985 using the VMS to identify existing conditions. VMS elements that were evaluated included: 1) variety classes, 2) viewer sensitivity levels, and 3) distance zones from highways and roads (see Glossary). These three elements are combined to develop VQOs for the study area. The variety classes, sensitivity levels, and VQOs were re-evaluated in 1994 for this draft EIS.

The first VMS element to be evaluated is variety class. The Rock Creek drainage is in an area where surrounding landforms and vegetation patterns combine to create scenic character that is common to the area (Variety Class B). In contrast, the landscape of the Clark Fork Valley near the mouth of Rock Creek has a distinctive scenic character (Variety Class A). Surrounding mountains rising dramatically from the valley floor, large lakes, and diverse vegetation patterns combine to create a highly scenic pastoral landscape. Cliffs in the CMW would be in an area having distinctive and unique scenic character (Variety Class A).

Viewer sensitivity (the degree of viewer interest in the landscape's scenic quality) is the second element evaluated for the visual resource inventory under the VMS. Viewer sensitivity was evaluated for roads, trails, and use areas in the study area. Montana Highway 200 through the Clark Fork Valley is a primary travel route with high viewer sensitivity and has been designated a scenic byway by the American Automobile Association (AAA). Noxon Reservoir also has high viewer sensitivity. FDR No. 150 forms a loop system from the Clark Fork Valley up the Rock Creek drainage and over Government Mountain. It provides access for dispersed recreationists and wilderness users. This road has moderate viewer sensitivity. FDR No. 2741, which provides 6.9 miles of motorized access to the wilderness boundary and trailhead near Chicago Peak, also has moderate viewer sensitivity. FDR No. 150A, located up the East Fork of Rock Creek and providing access to Rock Lake and the CMW, has high viewer sensitivity. Forest Trail 932 is located within the Rock Creek drainage near Orr Creek and provides access to Engle Lake in the CMW. It has moderate viewer sensitivity.

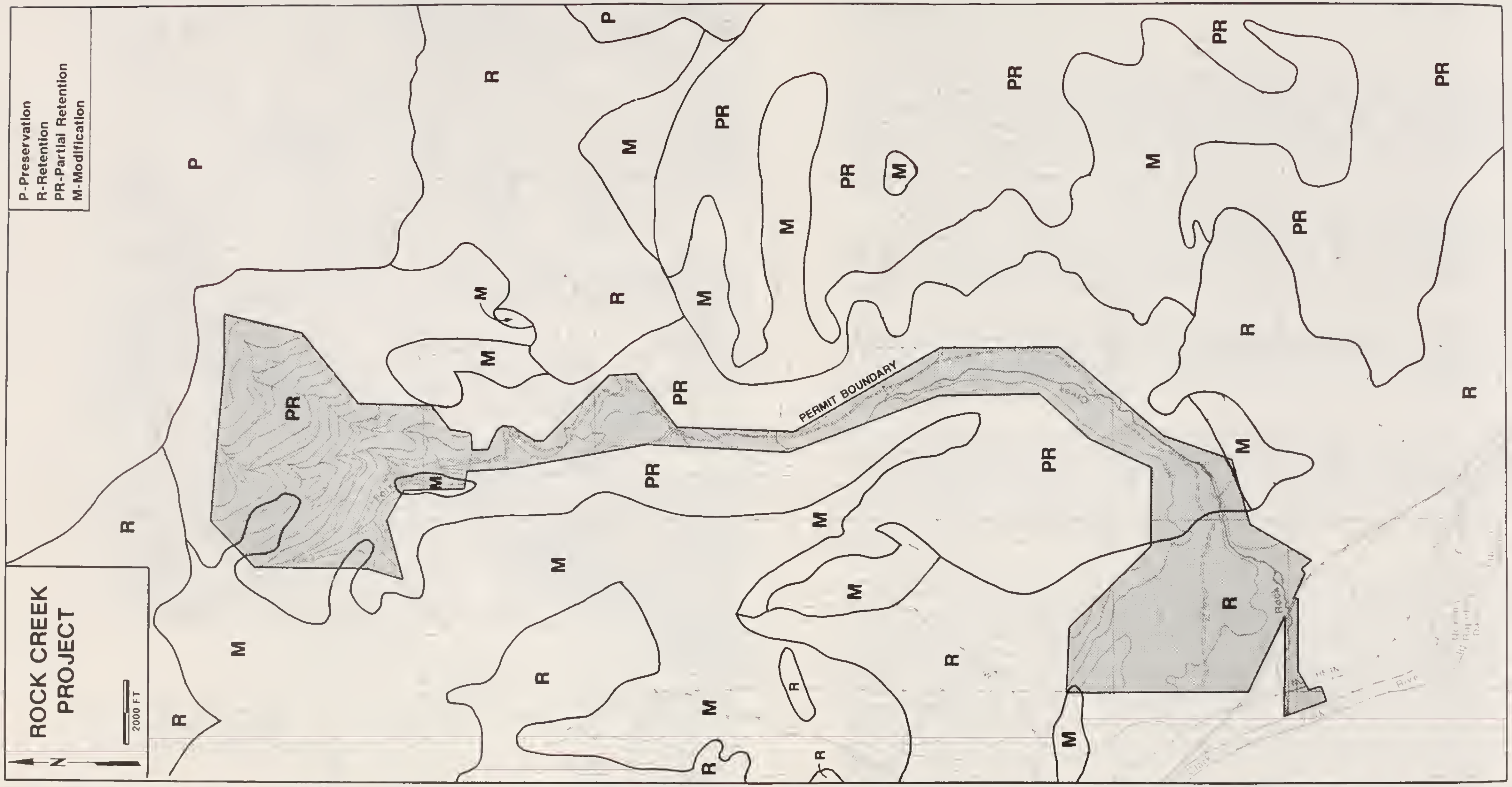


FIGURE 3-23
Visual Quality Objectives - VMS
Rock Creek Project

The McKay Creek drainage has several roads and trails used for dispersed recreation and access to the CMW. FDR No. 1022, located in the bottom of the McKay Creek drainage, has moderate viewer sensitivity. It provides access to several trails:

Trail 921 - Goat Ridge Trail	moderate sensitivity
Trail 923 - Bear Paw Trail	moderate sensitivity
Trail 924 - Wanless Lake Trail	high sensitivity

The final element inventoried for the VMS is viewing distance of proposed project facilities sites from highways, roads, trails, and other viewpoints. The VMS uses the terms foreground, middleground, and background to categorize viewing distances (see Glossary).

In the foreground, details can be perceived (e.g., individual boughs of trees form texture). In middleground views, texture is normally characterized by masses of trees and stands of uniform tree cover. Individual treeforms are usually discernable in very open or sparse stands. In typical background views, landforms are most noticeable while texture in stands of uniform tree cover is generally very weak or nonexistent. In very open or sparse timber stands, texture is seen as groups or patterns of trees. Color and line are usually more variable in foreground views and become muted and uniform with distance.

Foreground, middleground, and background viewing distances were identified for highways, roads, trails, and use areas within the proposed project area. These included: Montana Highway 200, Noxon, and the Noxon Reservoir in the Clark Fork Valley; FDR Nos. 150, 150A, 2741, and Forest Trail No. 932 in the Rock Creek drainage; as well as viewpoints within the CMW. The VMS identifies visible or seen areas based on landform screening but not vegetative screening that may change over time. Viewing distances for other areas were also evaluated that were farther removed from the project area or less used than the above areas.

Using the variety classes, sensitivity levels, and viewing distances zones that were inventoried and evaluated using the VMS, VQOs were developed for Forest Service, private, and state lands within the project area (see **Figure 3-23**). These objectives set measurable standards for the appearance of management activities. VMS VQOs developed for the project area include:

- ***Preservation*** - allows ecological changes only and management activities, except for very low visual-impact recreation facilities, are prohibited;

- ***Retention*** - land use activities should not be visually evident and the VQOs should be accomplished immediately;

- ***Partial Retention*** - land use activities remain visually subordinate to the characteristic landscape and do not attract attention. The VQO should be accomplished as soon after project completion as possible or at a maximum within the first year;

- ***Modification*** - land use activities may visually dominate the characteristic landscape, but they must be compatible with the natural surroundings. The VQO should be accomplished within the first year.

The Forest Plan also designates VQOs for each Forest Service management area that may be less restrictive than those determined through VMS (see **Figure 3-24**). Forest Plan VQOs for the project area range from Preservation for land within the CMW to Maximum Modification for some NFS lands that are not viewed from primary roadways. Applicable Forest Plan VQOs include the following:

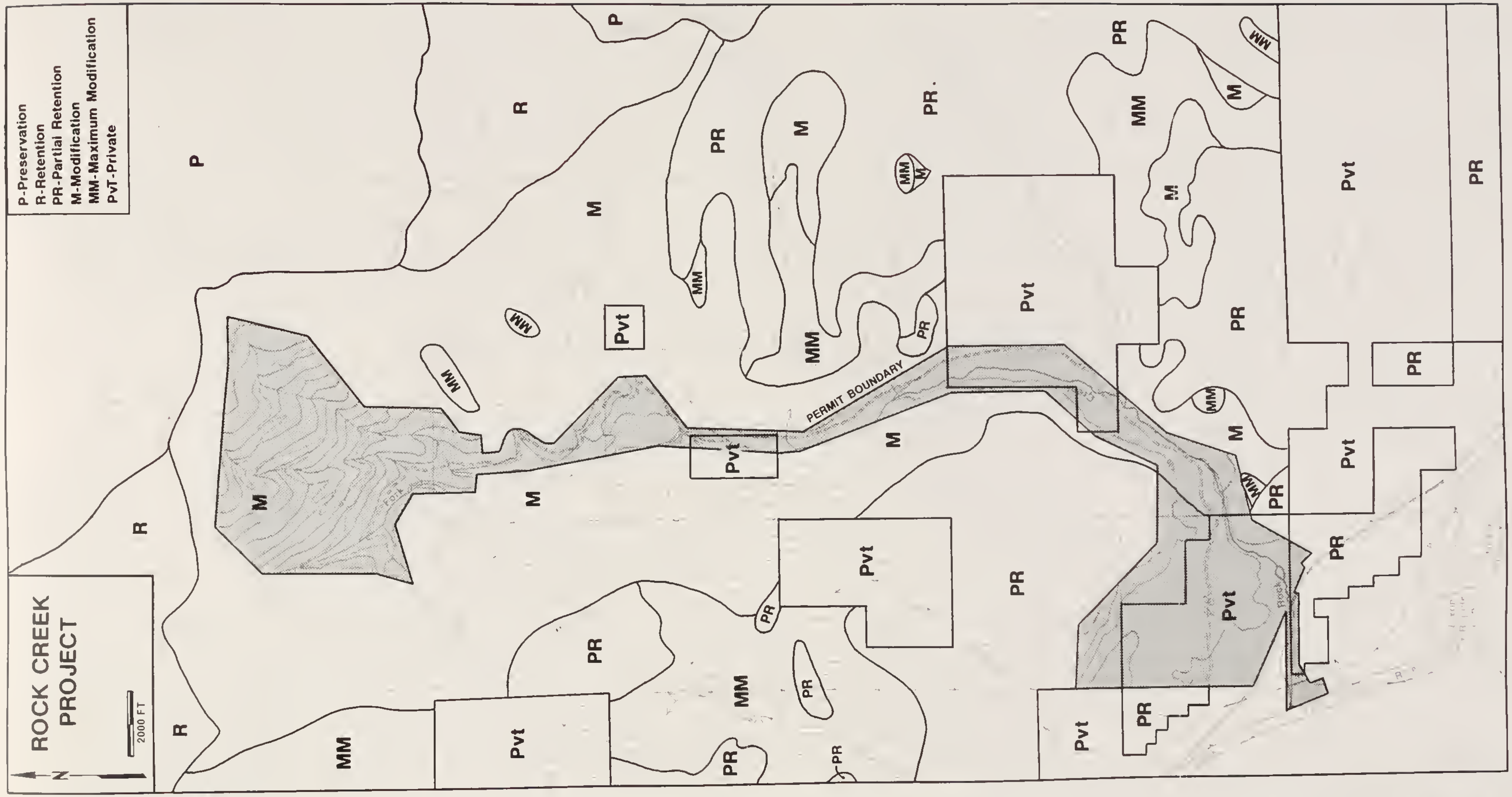
- ***Preservation*** - in general, human activities are not detectable to the visitor;

- ***Retention*** - human activities are not evident to casual forest visitors;

- ***Partial Retention*** - human activities may be evident but must remain subordinate to the characteristic landscape;

- ***Modification*** - human activities may dominate the characteristic landscape but must at the same time use naturally established form, line, color, and texture. They should look like natural occurrences when viewed in middleground or background; and

- ***Maximum Modification*** - human activities may dominate the characteristic landscape but should appear as natural occurrences when viewed as background.



Source: Adapted from Information in
Kootenai National Forest 1987.

FIGURE 3-24
Visual Quality Objectives - Forest Plan
Rock Creek Project

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

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CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains the Agencies' analysis of probable impacts to the human environment that would result from construction and operation of the proposed ASARCO Rock Creek Mine and its associated facilities (the Project). It also contains the analysis of probable cumulative impact that would result from adding the proposed project to other existing and reasonably foreseeable activities in the project area and the Cabinet Mountains Wilderness, in the vicinity of Noxon, Montana.

Assumptions for the Action Alternatives

Certain assumptions were made in the following discussions. The following assumptions are for the purpose of this analysis only. These assumptions are not intended to be the final projection of future activities that may or may not materialize in the area over the next 30 years.

Assumptions used by the Agencies to perform the impact analysis for alternatives II through IV include:

- Mining and reclamation technology would not change substantially throughout mine life.
- Labor, equipment, and/or market shortages/surpluses would not materially change projected levels of development.
- Impacts to copper/silver supply or demand are beyond the scope of this draft EIS.
- Mine production would last about 30 years. Exploration would last about 1 year and premining construction/development about 3 years. Although reclamation would be ongoing, postmining reclamation would last for 2 years. Life of the project is estimated to last about 35 years. However, some monitoring or mitigation might continue several years after mine closure.
- The project would be initiated sometime within the next 5 years.
- The ***short-term*** impacts of the project are those that would occur during the life of the project. ***Long-term*** impacts from the project are those that would persist beyond final reclamation bond release. *These impacts are discussed at the end of this chapter only if they would occur to a given resource.*
- An irreversible or irretrievable commitment of resources would occur when resources were either consumed, committed, or lost as a result of the project. The commitment of a resource would be ***"irreversible"*** if the project started a "process" (chemical, biological, and/or physical) that could not be stopped. As a result, the resource, or its productivity, and/or its utility would be consumed, committed, or lost forever. Commitment of a

resource would be considered ***"irretrievable"*** when the project would directly eliminate the resource, its productivity, and/or its utility for the life of the project. *These impacts are discussed at the end of this chapter only if they would occur to a given resource.*

- Qualitative terms are used to describe anticipated magnitude of impacts and, where appropriate, anticipated importance of impact to the human environment. ***"Significant"***, ***"potential to become significant"***, and ***"insignificant"*** describe importance (see **Appendix A**). *Impacts are considered to be insignificant unless identified otherwise.*
- ***Cumulative*** impacts are defined as collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Chapter 2.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. *Cumulative impacts are discussed at the end of each resource impact section.*

Methodology

Methods used to gather data used for impact analysis for all resource areas are on file at Kootenai National Forest (KNF) and Department of State Lands (DSL) and may be reviewed by any person or party.

PART 1: ANALYSIS OF IMPACTS BY RESOURCE

Impacts are addressed by alternative within each resource. Alternative I, the no-action alternative, has substantially different impacts than any of the action alternatives. *For all of the action alternatives, only those impacts that would differ from previous action alternative(s) are listed. The reader may assume then that all impacts listed under Alternative II would occur under the subsequent alternatives (III and IV) unless otherwise stated. All impacts under Alternative III would occur under Alternative IV unless otherwise stated.*

FOREST PLAN DIRECTION

Summary

Three amendments to the KNF Forest Plan would be necessary for the proposed project under all action alternatives. These amendments would reduce the amount of land classified as big game winter range (MA 11), old growth timber (MA 13), and grizzly bear habitat (MA 14). The amount of acreage reallocated would vary by alternative, from 273 acres to 362 acres.

Alternative I

Under Alternative I, there would be no changes to the Forest Plan except for amendments that addressed old growth in response to timber inventories. Compartment 711 would retain the current amount of acreage managed for old growth (MA 13) (see **Table 4-2**).

Alternative II

Timber sales offerings by the KNF in the Rock Creek drainage may be somewhat reduced during mine life because mining would reduce grizzly bear habitat to minimal or below Forest Plan levels in this Bear Management Unit (BMU). Reduced timber sales would result from the need to maintain open road density standards for grizzly bear management. Timber sales accessed by open roads would still be considered.

Mining activities will be encouraged under the appropriate laws and regulations and according to the direction established by the Forest Plan. While mineral exploration is an authorized use within these management areas (MAs), large scale mining development would reduce the area available for providing either grizzly bear or old-growth-dependent species habitat. This alternative would affect about 362 acres of NFS lands managed for big game winter range, old growth, and grizzly bear habitat. These lands are managed under the Kootenai Forest Plan (U.S. Forest Service 1987) as management areas 11, 13, and 14 (see **tables 4-1 and 4-2**). The proposed exploration adit would convert about 10 acres of grizzly bear habitat (MA 14) to mining uses for 1 year, and would permanently cover about 4 acres of grizzly habitat with waste rock.

TABLE 4-1.
Acres of NFS Lands To Be Reallocated

	Acres reallocated to MA 31 Mining			Acres Reallocated to MA 23 Utilities			Acres Reallocated to MA 11 Big Game Winter Range			Total Reallocated Acres		
Present Management Area	Alt. II	Alt. III	Alt. IV	Alt. II	Alt. III	Alt. IV	Alt. II	Alt. III	Alt. IV	Alt. II	Alt. III	Alt. IV
MAs suitable for timber harvest												
MA 11 Big Game Winter Range	157	157	157	19	32	32	N/A	N/A	N/A	176	157	189
MA 14 Grizzly Habitat	83	61	37	23	23	13	N/A	N/A	N/A	106	84	50
MAs unsuitable for timber harvest												
MA 13 Old Growth[1]	39	29	8	7	6	4	24	22	22	70	57	34
Total Acres to be Reallocated	289	247	202	49	61	49	24	22	22	362	330	273

Source: Kootenai National Forest 1995.

[1] Old growth acreage is acreage physically impacted along with an area between the mill and mine portals. For effective old growth habitat disturbed, see Biodiversity.

TABLE 4-2.
Changes to Old Growth (MA 13) by Alternative

	I[1]	II	III	IV
Old Growth Acres old growth lost	0	70	57	34
Acres old growth remaining	977	907	920	943
% reduction from current old growth		6.5	5.5	3.5
% old growth in Compartment 711	7	6.5	6.6	6.7
Replacement Old Growth Acres lost	0	6	3	0
Acres of remaining replacement old growth	537	531	534	537
% reduction from current old growth	0	1.1	0.6	0
% replacement in Compartment 711	3.8	3.8	3.8	3.8
TOTAL ACRES LOST	0	70	57	34
% MA 13 (TOTAL)	10.8	10.3	10.4	10.5

Source: Kootenai National Forest 1995.
[1] This column contains existing acreages and percentages of old growth.
Note: There are 13,923 acres in Compartment 711 below elevation 5,500 feet.

The proposed mine exploration adit, mine conveyer and ventilation adits, mill site, and that part of the tailings impoundment on NFS lands would be incompatible with all or part of the management requirements of MAs 11, 13, and 14. ASARCO did not propose any mitigations to resolve these conflicts. Possible MA mitigation measures (revisions) to be implemented by KNF are discussed below.

The road and/or utility corridor (including the proposed widening of FDR No. 150 to the mill site, the construction of water and tailings pipelines, mine access road, and 230 kV powerline) would disturb about 49 acres for over 30 years. The utility corridor would cross MAs 11, 13, and 14. (Rights-of-way for power- and pipelines may be authorized on a case-by-case basis in these MAs).

The proposed tailings impoundment would disturb about 324 acres. Only a portion of this land is managed by KNF (about 69 acres in MA 11); the remainder is owned by ASARCO. ASARCO has partially logged their lands in this area.

About 1 acre would be permitted for a ventilation adit on the north face of Saint Paul Peak, within the Cabinet Mountains Wilderness (CMW) (MA 7). The CMW is managed to keep the imprint of humans substantially unnoticeable and to allow ecosystems to operate naturally. ASARCO has established valid mineral rights by having acquired mineral patents, giving the company subsurface mineral ownership within the CMW.

An additional 24 acres of old growth would be removed for development of the borrow materials areas. These areas are located on either side of FDR No. 150B adjacent to Rock Creek (see **Figure 2-13**).

Management Area Revisions

Mining activities would necessitate changes to the Forest Plan by KNF. Two MA revisions covering about 362 acres would be necessary for the project to be in compliance with the Forest Plan. These would include revisions authorizing designation of an electric transmission corridor (MA 23[1]) and the full range of mine developments (MA 31[2]) (see **Table 4-1**).

At such time when the transmission line and other utilities were removed, that land designated as MA 23 would be re-evaluated and assigned to an appropriate MA. Lands under MA 31 would remain so designated well into the future to foster long-term reclamation of mining facilities.

Development of Alternative II reduces the BMU below the minimum standard of 70 percent for use by grizzly bears. Mitigations as described in Threatened and Endangered Species would be implemented.

Alternative III

Management Area Revisions

Under Alternative III, changes in the utility corridor and mine access road locations would result in revisions to MAs 11, 13, and 14 (see **tables 4-1 and 4-2**).

KNF MA revisions covering about 330 acres would be necessary for the project to be in compliance with the Forest Plan (see **Table 4-1**). Twenty-two acres of MA 13 would be removed for development of a borrow area (B-3), located on along FDR No. 150B, adjacent to Rock Creek (see **Figure 2-13**). This 22 acres would be redesignated as MA 11.

Alternative IV

Management Area Revisions

Under Alternative IV, shorter road and utility corridors and the lower mill site would result in fewer KNF revisions to MAs 11, 13, and 14 (see **tables 4-1 and 4-2**).

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[1] MA 23 Electric Transmission Corridor. This MA is to provide for the transmission of electricity in a safe and efficient manner by protecting adjacent lands, maintaining wildlife habitat and providing for grizzly bear habitat security. This MA applies to and is available for any future transmission line corridors on the KNF.

[2] MA 31 Mineral Development. MA 31 consists of permitted land areas that are directly involved with mineral production facilities such as major mine portals, mineral ore processing facilities, mineral tailings impoundments, water diversion structures, percolation areas, pipelines, and long-term equipment occupancy areas. They can be located in or adjacent to other MAs depending on the final approved location of the mine and the necessary supporting facilities.

CLIMATE

Mining of the project under all alternatives would not have a detectable effect on the climate of the area. The amount of air pollutant emissions would be too small to affect precipitation or radiation balance.

AIR QUALITY

Summary

Based on anticipated air pollutant emission levels and corresponding analyses under all action alternatives, the overall impact to air quality in the area, including the wilderness area, would be minor. There would be a relatively small, localized increase in particulate and gaseous pollutants at the mill site and tailings impoundment areas. Air pollutant levels should remain well below state and federal ambient air quality standards. ASARCO would implement an air monitoring program. Following completion of operations, air quality conditions would return to near-current levels assuming adequate revegetation success.

Alternative I

Ambient air quality in the area would remain similar to its current condition and to possible future air quality conditions unrelated to mine development. The primary future air quality impact would probably result from population growth with increased vehicle traffic and home heating. No new significant industrial air pollution sources are anticipated in the area at this time.

Alternative II

Air pollutant emissions associated with the operation would originate primarily from three distinct sources: 1) the underground mine with the exhaust ventilation adits being the points of emission discharge (initially the service adit and later primarily the exploration adit), 2) the mill site, and 3) the tailings impoundment. **Table 4-3** lists the estimated emissions from the project, including the emission control equipment and practices that would be used[3]. Total estimated emissions by pollutant type from the project are as follows:

Total suspended particulate (TSP) = 97.0 tons per year
Nitrogen oxides (NOx) = 64.0 tons per year
Sulfur dioxide (SO_2) = 9.9 tons per year
Carbon monoxide (CO) = 76.9 tons per year
Hydrocarbons (HC) = 9.6 tons per year

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[3] Experience and data gained from the Troy Mine and other similar mines have been used in this air quality analysis.

TABLE 4-3.
Estimated Pollutant Emission Inventory and Emission Controls for the Proposed Rock Creek Mine

Source/Activity	Pollutant	Uncontrolled Emissions (tons/year)	Type of Control Equipment/Practice	Estimated Control Efficiency (percent)	Controlled Emissions (tons/year)
Blasting	TSP	0.2	Stemming. Drill Hole Size Optimization. Rubble Watering.	--	0.2
	NOx	12.8	Control Overshooting.	--	12.8
	SO^2	1.5	Control Overshooting. Low Sulfur Fuel Oil.	--	1.5
	CO	50.3	Control Overshooting	--	50.3
Diesel Equipment	TSP	4.1	Particulate Matter Trap Renewal: Low Ash Fuel.	--	4.1
	NOx	132.3	DITA Engines[1]	65	46.3
	SO_2	8.4	Low Sulfur Diesel Oil	--	8.4
	CO	25.4	Frequent Tune-ups to Manufacturer's Specs	--	25.4
	HC	9.4	Frequent Tune-ups to Manufacturer's Specs	--	9.4
			Evap. Control System Maintenance	--	
Space Heating	TSP	0.2	Use Propane, Routine Maintenance Schedule	--	0.2
	NOx	5.0	Maintain Near-Stoichiometric Atmosphere	--	5.0
	CO	1.2	Maintain Near-Stoichiometric Atmosphere	--	1.2
	HC	0.2	Routine Fuel Delivery and Burner System	--	0.2
Primary Crushing	TSP	820.0	Inspection/Renewal	98	16.4
Secondary Crushing	TSP	1,735.0	High Efficiency Wet Scrubber	98	34.7
			High Efficiency Wet Scrubber		
Convey, Storage and Transfer of ore and Concentrate[2]	TSP	1,180.0	Enclosed Bins (Storage)	90	11.8
			Enclosed Conveyors	90	
			Baghouses (3) on Vents for Bins/Conveyors	99	
Road Dust	TSP	—	Paving	--	Neg.
Tailings Impoundment	TSP	59.2	Ponding, Sprinklers	50	29.6

Source: TRC Environmental Consultants, *In* ASARCO, Incorporated 1987-1994.

Note: The service adit is the emission point for blasting, diesel equipment, space heating, and primary crushing.

[1] DITA - Direct Injection Turbo - Charged Aftercooling

[2] This represents a combination of sources - the emission points are the tower vent, the ore bin vent and the ore silo vent

As part of the air quality permit application, ASARCO used EPA's Complex I and Industrial Source Complex (ISC) computer simulation models to predict TSP, PM-10 (particulate matter less than 10 microns), and NOx concentrations resulting from the project. The ISC model was used to predict TSP and PM-10 impacts near the proposed tailings area and the Complex I model was used for TSP, PM-10, and NOx from the proposed mine and mill area. A rectangular receptor grid 5 by 5.5 kilometers, centered in the proposed plant complex, was used for the Complex I model, with a receptor spacing of 500 meters. Additional receptors were located along the permit boundary. A rectangular array of receptors 1.8 kilometers by 1.8 kilometers with 200-meter spacing, centered on the proposed tailings area, was used with the ISC model.

An analysis of visibility impacts was also done using EPA's Level 1 and Level 2 screening techniques. Contrast parameters were computed to be less than criteria set by EPA, indicating that there would be no perceptible contrast change or general haze at the Cabinet Mountains Wilderness Area (CMW). The reduction in visual range was also predicted to be below perceptible levels. Infrequent, episodic events, such as high winds causing erosion of the tailings surface, could cause minor, short-term visual impacts from dust plumes that could be visible from the CMW and other areas.

Table 4-4 lists the modeling results. The maximum predicted concentration values include measured and assumed baseline concentrations. Applicable state and federal standards are included for comparison. All predicted concentrations are well below the applicable standards. Updated modeling is being prepared as part of the air quality permit application review process. It is assumed that the results will be similar to the original analyses.

Concentrations of potentially toxic trace metals in the particulate emissions were also analyzed. Specific metals included were lead, arsenic, cadmium, antimony, chromium, zinc, copper, and iron. This type of analysis is required for most large mining operations to identify whether any of these metals are present in sufficient quantities in the ore and/or tailings to create a hazardous condition from airborne particulate levels. The modeled TSP concentrations were multiplied by the mass fraction (percentage) of each metal in the ore and tailings. (Metals contents were based on data from ASARCO's Troy Project.) The resulting metals concentrations were then added to the measured background levels in the area. Predicted concentrations of lead are well below state and federal ambient air quality standards. There are no standards for the other metals. Concentrations for those metals are therefore compared against guideline values used by the Montana Air Quality Division. All concentrations were predicted to be below the guideline values.

As part of the air quality permit application review, the Montana Air Quality Division has reviewed and approved the above-referenced analyses. A final decision on the air quality permit application will be made after a public review process and completion of the EIS process. Proposed emission control practices (see **Table 4-3**) have been determined to represent Best Available Control Technology as required by the Montana Air Quality Rules. No further air quality mitigations are being proposed. Performance testing of specific control equipment would be required as a condition of the air quality permit. Ambient air quality monitoring near the mine/mill and tailings areas would also be required.

TABLE 4-4.
Comparison of TSP Modeling Results with Ambient Air Quality Standards

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal Standard (ug/m^3)	Montana Standard (ug/m^3)[1]
Mine/Mill	Annual (geom)	30.2	60	–
	Annual (arith)	36.9	–	75
	24-Hour	91.5	150	200
Tailings	Annual (geom)	15.7	60	–
	Annual (arith)	22.7	–	75
	24-Hour	34.1	150	200

Comparison of PM-10 Modeling Results with Ambient Air Quality Standards

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal and Montana Standard
Mine/Mill	24-Hour	107.4	150
	Annual (arith)	24.2	50
Tailings	24-Hour	58.6	150
	Annual (arith)	16.7	50

Comparison of NO^2 Modeling Results with Ambient Air Quality Standards

Source	Averaging Time	Max. Predicted Concentration (ug/m^3)	Federal Standard (ug/m^3)	Montana Standard (ug/m^3)
Mine/Mill	Annual (arith)	21.1	100	100
	1-Hour	319.9	—	566

Source: TRC Environmental Consultants, Inc. 1987.
Note: [1] ug/m^3 = micrograms per cubic meter

A specific air quality concern is the potential for wind erosion from the tailings impoundment area. If tailings surfaces were allowed to dry, there would be a significant potential for wind erosion to occur, given the fine texture of tailings material. The impoundment would be designed such that a third of the surface would be completely submerged at all times. The remainder, along with the impoundment face, would have a water-sprinkling system for dust control. Naturally occurring precipitation would also provide some measure of dust control. The factors noted above, as well as average meteorological conditions, were used in estimating potential wind erosion emissions. Even with these controls, some wind erosion may occur during high wind conditions; however, particulate levels should remain well below the applicable ambient air quality standards and should not cause a nuisance from blowing dust. The overall efficiency of control would depend primarily on the company's diligence in maintaining a wetted surface. The adequacy of this control would be evaluated through ongoing air quality monitoring and visual observation. Other wind erosion control measures that the company may use or that may be required by the Agencies in the future, based on the evaluation noted above, may include:

1. The establishment of a temporary vegetative cover on portions of the tailings surface and embankment;

2. chemical stabilization of some areas;

3. upgrading of the sprinkler system to provide more extensive coverage and water availability; and

4. development of a detailed sprinkler operating plan that would be updated as the tailings surface expanded. This may include specific record-keeping requirements such as times of sprinkler operation and the amount of water used. A minimum threshold wind speed, above which sprinkling would be required, could also be developed.

Another specific concern is the potential air quality impact to the CMW. This area is designated as Class I under the Prevention of Significant Deterioration (PSD) regulations as described in Chapter 3, Air Quality. The review of PSD requirements is carried out primarily through the analysis of permit applications for "major stationary sources." The Rock Creek Project is not classified as a major stationary source because estimated emissions by individual pollutant type are less than 250 tons per year. Although the PSD regulations do not apply directly to the proposed project, many of the specific PSD requirements have been applied. These include 1) preconstruction and postconstruction ambient air monitoring, 2) computer simulation modeling of emission impacts, 3) an analysis of visibility impacts, and 4) the application of Best Available Control Technology to emission sources.

Table 4-5 lists modeling results showing the maximum predicted pollutant increases in the wilderness area. The corresponding PSD allowable Class I increments are also shown for comparison purposes although they are not applicable to the project.

TABLE 4-5.
Maximum Predicted Increases in Class I Area

Pollutant	Averaging Time	Increase (ug/m^3)[1]	Allowable Increment (ug/m^3)
TSP	24-Hour	4.2	10
	Annual	0.4	5
NO_2	Annual	0.7	2.5

Source: TRC Environmental Consultants, *In* ASARCO, Incorporated 1987-1994.
Note: [1] ug/m^3 = micrograms per cubic meter

Construction activities, primarily on the tailings impoundment, have a high potential for fugitive dust emissions. Work areas and temporary haul roads would be watered or chemically stabilized to control these emissions, and topsoil storage areas would be promptly revegetated to minimize wind erosion. Paving FDR No. 150 would alleviate dust problems associated with haul trucks on the gravel road. Slash burning related to construction activities would be regulated under the open burning provisions of the Montana Air Quality Rules.

Development of the exploration adit would cause short-term particulate and gaseous emissions similar to development of the primary adits. Additional emissions, primarily nitrogen oxides, would result from onsite diesel generators. Use of the adit for exhaust ventilation in the future would not increase project emissions but would shift some of the emissions location from the mill area to the exploration adit area. Additional emissions from power generators and the ventilation emissions would not occur at the same time. These impacts would be minor.

Secondary or indirect air quality effects related to the project would result from population growth. These would be primarily from increased vehicle traffic and home heating/wood burning, but would not be expected to exceed ambient air quality standards.

Alternative III

Mitigations proposed under other disciplines would not appreciably affect the air quality impacts described under Alternative II. The use of the alternative rail load-out at Miller Gulch would result in a shift of the relatively minor amount of emissions associated with this activity. The use of a modified centerline construction method for the tailings impoundment increases the amount of exposed tailings surface due to delayed reclamation of the embankment face. This would result in a higher potential for wind erosion during the 7 years of centerline construction.

Alternative IV

There would be a slight increase in particulate emissions associated with the alternative mill site. This would result from the additional waste rock handling needed. The emission points and impacted areas would change corresponding to the new location of the mill. Neither the slight changes in emissions or the relocation of emission points would substantially alter the overall air quality impacts of the project.

Cumulative Impacts

Cumulative air quality impacts under all action alternatives would be reviewed for specific proposed projects and developments that require air quality permits in the area. Logging and small scale mineral exploration activities typically do not require air quality permits; however, general air quality conditions would be analyzed through ASARCO's ambient air quality monitoring program. Slash-burning activities are regulated by open burning rules. Particulate and gaseous emissions (primarily NOx and CO) would increase in proportion to increased vehicle activity associated with future logging and/or mineral development; however, it is not likely that ambient air quality standards would be approached. The air quality permit process and specifically the PSD regulations would act to regulate and possibly limit future development based on cumulative impact. No measurable cumulative or additive impact would be expected with respect to Noranda's Montanore Project based on distance and topographic considerations. Population growth unrelated to the project may increase vehicle traffic and home-heating/wood-burning emissions. Cumulative emissions likely would not exceed air quality standards.

GEOLOGY

Summary

Construction of the project facilities for all action alternatives would alter the existing topography and surface water drainage patterns in the tailings impoundment area (Miller Gulch). The most noticeable alterations of existing topography would be the construction of a tailings impoundment and mill site.

Mining would result in a total production of about 166 million ounces of silver and 1.37 billion pounds of copper. This would increase domestic production of these metals and would have a positive effect on the U.S. gross national product and balance of trade.

Toward the end of mine life under Alternative II, the potential exists for subsidence from pillar robbing, in turn causing the potential for subsidence of ground surface and draining of wilderness lakes. Alternatives III and IV would include measures that would minimize the risk of subsidence and related impacts.

Alternative I

If the proposed project was denied, it is likely that ASARCO or other companies or individuals could conduct further evaluation of the Rock Creek or other nearby ore deposits. Continued exploration for other metals may occur. These exploration activities could lead to development of a mine or mines to develop these deposits.

Alternative II

Geologic Resources

Current ore reserves of ASARCO's Rock Creek deposit are estimated by ASARCO at about 144 million tons at an average grade of 1.65 Troy ounces of silver per ton and 0.68 percent copper, or about 14 pounds per ton. ASARCO's proposed operation would remove approximately 70 percent, or about 100 million tons, of the mineral deposit. (This estimate is based on preliminary mine design information. Underground studies may change this figure.) Mining would result in a total production of about 166 million ounces of silver and 1.37 billion pounds of copper. This would increase domestic production of these metals and would have a positive effect on the U.S. gross national product and balance of trade.

Approximately 30 percent of the ore body would remain in the ground; about 25 percent to provide structural support for the mine workings and about 5 percent to protect underground installations and barriers to provide ventilation control. ASARCO's plan also includes maintaining a minimum of 100 feet of rock overburden where the ore body occurs near outcrops. This amounts to a potential unrecoverable resource of up to 73 million ounces of silver and 60 billion pounds of copper. The ability to recover the remaining ore would depend on metal prices and structural modifications necessary to mine the pillars without loss of structural support. Essentially all the recoverable ore from the Rock Creek ore body would be removed under all action alternatives.

Topography and Geomorphology

Construction of the surface facilities, tailings impoundment, and deposition of adit waste rock for the ASARCO project would alter the existing topography and surface drainage system. The tailings impoundment, mill site, and waste rock dumps would remain as permanent landforms following mining operations. Postmining topography of the impoundment embankment would be uniform and linear. (See Scenic Resources for discussion about visual impacts of operating and reclaimed mine facilities.)

Subsidence

The potential environmental consequences from the collapse of underground openings include surface subsidence, a change in the ground water regime, and drainage of surface waters.

Surface subsidence is the observable topographic change from collapse of underground openings. The potential for and amount of surface subsidence is very much dependant on the strength of the rock, the amount of physical support provided by the mining method used (types of ground support used in the openings, number and size of pillars, and size of the rooms), and the stress distribution (way in which pressure is spread within rock) in the surrounding rock.

ASARCO has not generated analytical rock mechanics data for the Rock Creek site with which to develop their mine plan. Most of this data would be obtained during the construction of the exploration adit as well as both mine adits. Much of the existing information regarding rock strength, artificial support, and room-and-pillar sizing and spacing is extrapolated from experience gained at ASARCO's Troy Mine. It is difficult to predict the consequences of ASARCO's proposed plan at Rock Creek based on the current level of information, however, a preliminary assessment prepared by Camp, Dresser & McKee, Inc. (1989) concluded that the potential for subsidence was remote. Using rock strength information from the Montanore Project and the Troy Mine, both hosted in the same geologic formation as the Rock Creek deposit, rock strength and quality are expected to be of similar nature and therefore, not indicative of subsidence-prone conditions.

Two reports (Redpath Engineering 1991; Agapito and Associates 1991) addressed mine planning and included information on subsidence at the nearby Montanore site. These reports concluded that, given the proposed mine plan (which is also room-and-pillar) and geologic conditions, the potential for subsidence at Montanore is minimal provided adequate underground monitoring and rock analysis are carried out to refine the mine design once development is underway. Given the similarities in rock strength and mining method, a predisposition towards subsidence would not be expected to exist at ASARCO's Rock Creek site, contingent on adequate monitoring and rock analysis. ASARCO has not committed to any specified level of monitoring and rock analysis as part of its proposed action.

ASARCO has identified thick ore horizons (over 150-feet thick) next to the Copper Lake and Moran faults. The ore body is exposed to the surface (outcrops) on its southeast and northeast edges (see

Figure 4-1). ASARCO's plan is to mine within 100 feet of the ground surface (ASARCO, Incorporated 1987-1994) in areas where the ore body outcrops at the surface. There exists the minor possibility that these areas (see **Figure 4-1**) could experience some surface subsidence under Alternative II if the induced stress field due to mining was larger than the strength of the surrounding rock. In simpler terms, once mining occurs, the overlying material has a tendency to collapse into the mine openings, depending on the ratio of overburden thickness to mine opening height, and mining method used. When ore is removed, some of the stress within the overlying rock is redistributed to the pillars and walls. Where there is no opportunity left for stress redistribution and/or stress exceeds rock strength, the back (roof) may collapse and/or the pillars fail. This, in turn, could cause surface subsidence.

The potential impacts to the ground surface, the ground water system, or to any surface lakes or streams in the area are unknown but considered remote. However, possible effects from subsidence could include partial to total dewatering of surface waters (e.g., Copper Lake, streams, and springs), a change in the ground water regime due to underground rock fracturing, and the development of surface cracks and topographic depressions.

Overburden thickness between the ore horizon and Copper Lake is about 900 feet while overburden thickness increases to 1,100 feet below Cliff Lake. Ore thickness is 100 to 150 feet and 10 feet, respectively, in these areas. Should rock immediately above mine openings fail, it would break into blocks. It would take fewer of the fallen blocks and intervening voids to fill the opening than the amount of material originally excavated. The increase in void space is known as the swell or bulking factor. Typical swell factors are between 40 and 60 percent for the type of material and rock strengths found at Rock Creek. The ability of rock to swell, filling a greater space than what it once occupied when consolidated, is the phenomenon that would counteract potential for subsidence.

Predicting whether subsidence will occur, let alone its extent, historically has been based on an empirical approach. Mathematical models to predict zones of collapse from mining have been formulated, however these models are greatly dependent on characterizing the complex interaction of local rock type and structural conditions. Using summary information from observed incidents of subsidence (U.S. Geological Survey 1980), a gross estimate can be made regarding the extent of the roof collapse above the Rock Creek ore body. Given the rock type and swell factor of the overlying material, and using an average room height of 30 feet, upwards of 200 feet of rock above the ore horizon could be affected by mining. That is to say that the overlying rock could potentially collapse and (more likely) fracture for a height of 200 feet above the mined horizon. In the vicinity of Copper Lake, this would leave approximately 700 feet of undisturbed rock between the lake bottom and this zone of impacted rock. The depth to disturbance beneath Cliff Lake would be even deeper, approaching 1,000 feet. The potential for subsidence increases as the ore thickness increases and/or the amount of overburden decreases. In areas where the ore horizon thickens to greater than 75 feet (Copper Lake and Moran fault zones) ASARCO proposes to use a horizontal pillar between rooms to increase stability (see **Figure 2-9**). Doing so would minimize stresses the support pillars would carry, thereby reducing the potential for subsidence. The areas where these conditions exist are highlighted on **Figure 4-1**. In areas other than those depicted, subsidence is highly unlikely given the strength of the rock, thickness of the ore body, and the depth of the ore. The potential for subsidence above thick or shallow ore bodies is low; if subsidence occurred impacts could be potentially significant.

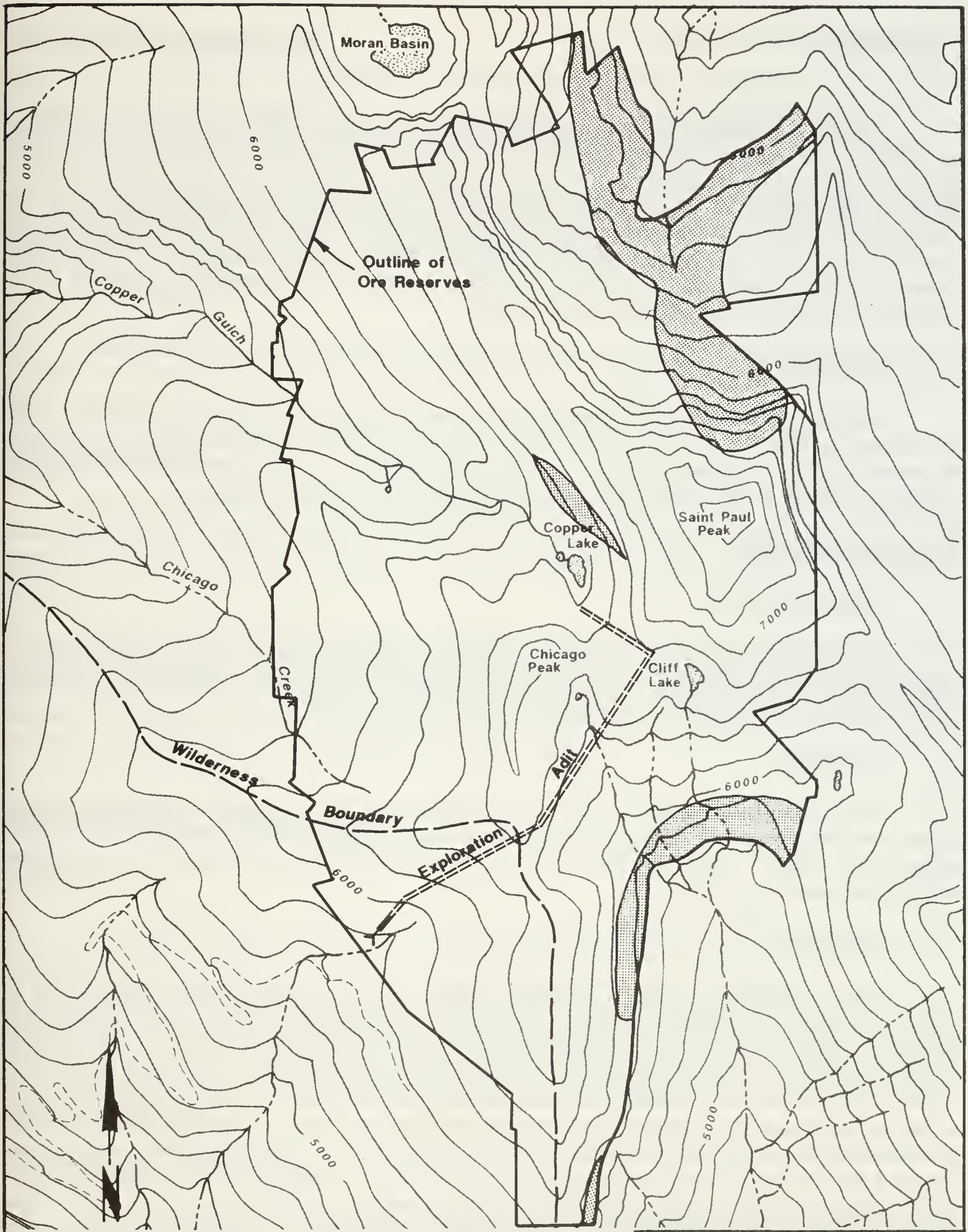

FIGURE 4-1
Areas of Potential Subsidence
Rock Creek Project

Source: Thompson 1990.

ASARCO's intention to remove select pillars towards the end of mining may cause rock fracturing and subsidence in areas not previously identified. This phenomenon has been observed in other room-and-pillar operations, and is especially prevalent in coal mines. The likelihood for this happening would depend on the strength of the remaining pillars and the stress field in the surrounding rock. A comprehensive testing and monitoring program to provide the information necessary to fully assess the potential for such an event has not been proposed by ASARCO. The potential for subsidence from removal of pillars is moderate; if subsidence occurred, impacts could be potentially significant above portions of the ore body that are close to the surface.

Slope Stability

There is some potential for slumping related to proposed construction (primarily cutslopes) of the new segment of FDR No. 150 on lacustrine silts and clays near Montana Highway 200 and of the mine adit access road in some steep areas on residual soils (see Soils). If slumping were to occur due to placement of access roads, potential for erosion and sediment yield would increase.

Alternatives III and IV

Geologic Resources

If pillar sizes were increased or areas of the deposit restricted from removal, there would be a reduction in the amount of geologic resource affected by the proposed project. Secondary impacts would result to ASARCO because revenues from the project would be reduced.

Topography

Under alternatives III and IV, postmining topography of the impoundment embankment would appear more natural due to modified reclamation that would construct and regrade slopes to give them curvature and variety. Under Alternative IV, the mill site would be constructed and reclaimed to blend with adjacent natural topography.

Subsidence

Under alternatives III and IV, ASARCO would be required to provide the Agencies with an updated underground mine design within 2 years of operation (after mill startup). The Agencies would conduct a design review and identify any potential problems that could lead to subsidence. The purpose of this review would be to verify conclusions reached during ASARCO's preliminary mine design. The Agencies may require modifications of the mine plan if significant problems were noted that could lead to surface subsidence and resultant effects to ground and surface waters. ASARCO would be required to submit detailed mine development plans in advance of entering areas of suspected rock instability (see **Figure 4-1**). ASARCO would be prohibited from removing or reducing the size of pillars without Agency approval. These requirements would effectively preclude subsidence or other surface effects related to mine-induced fracturing that are possible under Alterative II. The Agencies also may require leaving more ore in the ground for support. The amount of additional ore left underground, if any, would be small (several percent or less). The precise amount cannot be determined at this time.

These alternatives could also result in a secondary impact to ASARCO because less ore would be available. The potential for subsidence would be reduced from Alternative II under alternatives III and IV but impacts from subsidence would be potentially significant.

Slope Stability

These alternatives would involve relocation of FDR No. 150 and elimination of ASARCO's proposed mine portal access road, thus precluding potential slope failure as discussed under Alternative II.

Cumulative Impacts

Both ASARCO and Noranda would mine strataform copper/silver deposits from metasedimentary rock in the CMW. Estimated minable reserves for the two projects total 195 million tons of ore. The mineral deposits are sufficiently isolated from each other that no cumulative subsidence impacts are expected.

Construction and operation of both the proposed Rock Creek Project and Noranda's permitted Montanore Project could result in more stringent requirements on other mineral activities in the area in order to ensure sufficient undisturbed habitat for the grizzly bear, or to mitigate for other resource impacts. The result would be a slowdown in mineral exploration and permitting of potential future mineral developments in the area during the life of these projects.

GEOTECHNICAL ENGINEERING

Summary

Geotechnical review and analysis indicate a tailings impoundment structure can be safely constructed on the proposed site. However, the original "upstream" design (Alternative II) did not contain enough design and construction information to demonstrate adequate stability in the event of an earthquake. The "modified centerline" design, including review of the final design by a technical review panel and formal agency approval prior to construction (alternatives III and IV), does provide adequate assurance of safety in the event of an earthquake. Prudent design practice and methods and construction monitoring would reduce the risk of catastrophic failure to an exceedingly low level, commensurate with other dams of this size.

Potential Impoundment Failure

Failure of the tailings impoundment, while highly unlikely to occur, would cause major significant impacts. Due to the speculative nature of precisely describing a catastrophic event, the exact impacts of a tailings impoundment collapse cannot be predicted. Past experience with such occurrences has shown that the combined water and tailings can flow for long distances over relatively flat ground. It would be possible that such an occurrence at Rock Creek would allow tailings and water to reach Montana Highway 200, Rock Creek, and the Clark Fork River. The drastic consequences associated with an impoundment failure, however unlikely, justify high degree of review during design and construction.

There are four general ways the tailings impoundment could possibly fail. These potential failure mechanisms are not unique to a particular design alternative, but the Alternative II impoundment design (upstream construction) is inherently less protective than the design for alternatives III and IV (modified centerline construction). The general potential failure mechanisms are briefly described below. Further discussion is included in **Appendix E.**

> ***Foundation Sliding.*** Slippage in the ground beneath the tailings embankment could cause collapse of the impoundment and release of tailings and impounded water. Potential sliding in the foundation would be associated with soft clay deposits identified under some parts of the tailings embankment.
>
> ***Seepage-Induced Piping.*** The tailings impoundment could collapse due to impounded water seeping through the dam and exiting on the downstream face with enough force to erode the sand in the embankment. This internal erosion, known as "piping", could lead to collapse of the impoundment and release of tailings and impounded water.
>
> ***Overtopping.*** Wash-out of the impoundment could occur when the water level in the pond reached the crest height of the impoundment. An overtopping failure would release both tailings and water, but would involve more water than the sliding or piping. Threat of overtopping is typically associated with very extreme rainfall runoff events such as the probable maximum flood (PMF). For visualization purposes, the PMF at the site would be the flood resulting from roughly 15 inches of rain falling in 1 day. A PMF, with or without a tailings impoundment failure, would result in very severe flooding and associated damage.
>
> ***Earthquake-Induced Liquefaction.*** Collapse of the tailings impoundment could be caused by major earthquake shaking leading to "liquefaction" of the tailings in the impoundment. Liquefaction failure could lead to release of tailings and impounded water.

The proposed action alternatives offer differing levels of resistance or design approach for these potential failure modes.

Alternative I

The risk of an impoundment failure and associated impacts would not exist.

Alternatives II

Alternative II would involve an upstream tailings impoundment as proposed by ASARCO. This alternative addresses the four potential failure mechanisms as follows:

> ***Foundation Sliding.*** Soft clay deposits tend to slip if they are loaded too quickly for the water in the clay to drain away. Alternative II proposes to use a slow rate of loading and "wick drains" to enhance water drainage in the clay.
>
> ***Seepage-Induced Piping.*** Piping tends to happen if the water seeping from inside the dam reaches the downstream face of the dam. Alternative II proposes a combination of free-draining starter dams and blanket drains to intercept seepage water before it could reach the face of the dam. Intercepted seepage water would be collected and pumped back to the impoundment.
>
> ***Overtopping.*** Alternative II proposes diverting upgradient runoff from all precipitation events up to a PMF around the facility and having enough water storage to hold a PMF that might fall on the impoundment. However, for the first 3 years of impoundment construction, containing the PMF would require the water to move closer to the dam crest than the 200-foot distance given as the minimum operational distance in the design. This encroachment would increase the risk of seepage-induced piping.
>
> ***Earthquake-Induced Liquefaction.*** The upstream method of construction proposed for Alternative II is typically susceptible to earthquake-induced liquefaction. ASARCO has committed to a final design process that would include detailed laboratory testing and verification of the liquefaction resistance of upstream-placed tailings, and monitoring of the placed tailings density to address susceptibility to liquefaction. Alternative II would include a life-of-mine construction monitoring plan with formal reports to the Agencies and periodic performance reviews by experienced professional engineers.

Foundation slippage and seepage-induced piping can be adequately addressed with ordinary construction methods, and the risk associated with overtopping is acceptable. However, the level of information available regarding liquefaction resistance did not support preliminary approval (during application completeness reviews) of an upstream facility.

Impacts from a tailings impoundment failure would be significant if it occurred. The level of risk of occurrence under the Alternative II impoundment design would be unacceptable to the Agencies.

Alternatives III and IV

In response to Agency concerns about the Alternative II design, ASARCO redesigned the impoundment. The new design, included in alternatives III and IV, combines the centerline and upstream construction methods into a "modified centerline" method (see **Figure 2-3**). Centerline construction would be used for the first 7 years; the upstream method would be used after year seven. This design addresses the four potential failure mechanisms as follows:

Foundation Sliding. Same as Alternative II, however the excavation and removal of soft clay would reduce the sliding potential of the impoundment foundation.

Seepage-Induced Piping. Seepage would be intercepted by a 200-foot-wide shell of coarser sand placed at the downstream toe of the embankment during the initial 7 years of construction. The method of seepage collection is different because it is dependent on the method of construction, however the risk of piping remains about the same as Alternative II. Intercepted seepage would be returned to the impoundment similar to Alternative II.

Overtopping. Same as Alternative II, but the minimum operational distance between the pond and the top of the embankment would be 400 feet. For an undetermined period of time during starter dam construction, the dams would not be capable of containing a PMF.

Earthquake-Induced Liquefaction. The modified centerline method of construction for alternatives III and IV is typically less susceptible to earthquake-induced liquefaction than upstream construction. Alternatives III and IV would contain additional requirements to mechanically compact tailings as needed to meet liquefaction resistance criteria determined during final design.

In addition, alternatives III and IV include the Agency-imposed requirement that final design be reviewed by a technical panel and approved by the Agencies prior to construction.

Under alternatives III and IV, foundation slippage and seepage-induced piping can be adequately addressed with ordinary construction methods. The risk associated with overtopping is acceptable. Additional design and construction controls would improve earthquake resistance of the impoundment, and the Agency-imposed design review by a technical panel provides further assurance of impoundment stability.

Impacts from a tailings impoundment failure would be significant if it occurred. The level of risk of occurrence under the impoundment design for alternatives III and IV would be acceptable to the Agencies.

SOILS AND RECLAMATION

Summary

Impacts on the soil resource under all action alternatives would be similar and would include loss of soil characteristics developed over 10,000 years, actual soil loss, and decreases in site productivity. Soil development losses and site productivity reductions would be long term, primarily in the tailings impoundment area. Modifications and mitigation measures proposed by the Agencies would minimize these impacts. In turn, the potential for reclamation success would be improved and mitigation of impacts identified for other resources would be enhanced by reclamation plan changes proposed by the Agencies. Overall, impacts under Alternative IV would be less than those under alternatives II and/or III primarily *because less land would be disturbed (including less miles of road) and reclamation of the confluence mill site and the tailings impoundment would be more efficient and effective.*

Introduction

Recognition of inherent soil properties and design of salvage programs to retain favorable properties that have taken over 10,000 years to develop can enhance reclamation success. Soil characteristics that are important to consider for analyzing impacts and assessing soil salvageability and suitability for reclamation include:

- depth and horizon (developed soil layer) sequence;
- texture (relative proportion of sand-, silt-, and clay-sized particles);
- rockiness (both size and amount);
- erodibility;
- organic matter content;
- reaction (refers to the acidity or alkalinity of the soil solution and is expressed as pH ranging from 1 to 13, where 1 is most acid, 7 is neutral, and 13 is most alkaline or basic);
- nutrient status;
- susceptibility to compaction;
- slope steepness; and
- location and extent of rock outcrop and talus.

Soil impacts resulting from any of the action alternatives, typical of any operation where soil is removed, stored, and replaced, would include 1) loss of soil development and horizonation, 2) soil erosion from disturbed areas and losses of suitable salvage materials through erosion and handling, 3) reduction of favorable physical properties, 4) reduction in biological activity, and 5) changes in nutrient levels. Mine wastes used as subsoil and even some native subsoils may contain elemental concentrations of potentially harmful metals that could affect plant growth.

These impacts, combined with the proposed project's reclamation plan, determine in part, the potential success of restoring the land to forest cover and wildlife habitat after operations ceased. Limited reclamation success, in turn, may result in secondary or long-term negative impacts including soil erosion and sedimentation to streams, reduced soil/site productivity, visual deterioration, and seasonal air pollution increases due to wind erosion.

Alternative I

Erosion and sedimentation would increase in the Rock Creek drainage by some amount as a result of proposed Forest Service and private timber harvests, new road construction, and development of other private land (see Hydrology).

Alternative II

Soil Impacts

Soil Loss. Under Alternative II, about 583 acres would be disturbed (see **Table 2-1**). Soil erosion caused by wind or water (rainfall and runoff) is likely to occur during all phases of the proposed project. Initial erosion rates are expected to be moderate to high due to soil characteristics, slope steepness, and precipitation patterns.

Areas cleared of soil generally are more susceptible to erosive forces. This is because subsoils tend to have lower inherent infiltration and percolation rates. Lower infiltration and percolation rates increase the potential for runoff; compaction due to equipment operation would aggravate this.

ASARCO's proposed relocation of FDR No. 150 would cross lacustrine soils. When wet, these soils have a high slump potential. Road fill slopes would be particularly susceptible to failure, and difficult to revegetate. Other soils generally are well suited to road building, although cut-and-fill slope raveling (movement of dry soils) can be difficult to control. Road construction on steep slopes (greater than 60 percent) through small drainages on colluvial/residual soils, such as the access spur roads to the mine portal and the waste rock dump, takes special consideration to ensure that slope stability is not affected (see Geology and Transportation).

The transportation corridor would result in a total disturbance area of 96.1 acres from road construction/reconstruction as well as pipeline and powerline construction. Erosion from the transportation system would likely increase during and after (up to 4 years) construction and reconstruction until cut-and-fill slopes were stabilized (see Hydrology).

Some areas such as the utility corridors would be reclaimed as work progressed, so surface erosion would be limited. It is well documented, however, that road-building in steep terrain results in accelerated erosion and sedimentation (Megahan and Kidd 1972; Packer 1966). Increases are highest within the first 2 years but erosion continues for long periods depending on site conditions. Because precipitation is high in the Rock Creek area, it is essential to stabilize cut-and-fills immediately to reduce potential erosion rather than waiting until spring or fall (Lou Kuennen, Kootenai National Forest, personal communication, January 13, 1989). However, ASARCO proposes to seed in the first appropriate season following construction. Planting and seeding are typically done in spring or fall when soil moisture conditions are optimum. Delays in seeding highly erodible sites, however, often results in crusting of the soil surface, in turn reducing seed establishment and resulting in more erosion.

Unprotected road surfaces would also be susceptible to erosion. ASARCO plans to pave FDR No. 150 to the facilities area. This would greatly reduce potential erosion from this road surface. Other roads would be graveled which also reduces potential erosion but to a lesser extent. Drainage from road surfaces would be controlled using BMPs. With the exception of the access road to the exploration adit and utility maintenance roads, no roads would be fully reclaimed (obliterated, recontoured, and reseeded). One new and two replacement bridges would be constructed (see Transportation). The skewed alignment of the new bridge would disturb more area than would a perpendicular alignment and also exposes more of the bridge structures and fill slopes to erosion or washout. The areas associated with construction and removal of detour bridges for the replacement bridges also would be subject to erosion until stabilized. Short-term increases in sedimentation may occur as a result.

Roads would be used year round. Maintenance activities such as ditch clearing and snowplowing may result in small increases in erosion. Where culverts discharged near Rock Creek or other streams, or where roads were close to streams, the potential for sedimentation would increase.

Erosion resulting from disturbances associated with upgrading the Hereford rail load-out facility would be minimal.

All soil stockpiles would be susceptible to erosion for several reasons. Constructed sideslopes and ramps would be relatively steep: 40 and 33 percent, respectively. Some stockpiles would be expanded incrementally, leaving soil on the active face exposed. Some portion of all stockpiles would be in place for the life of the mine. ASARCO proposes implementation of interim seeding (see Reclamation) only when stockpiles approached planned volume. If left exposed and unprotected for more than a couple of months, regardless of other characteristics, large amounts of soil may erode. This erosion would be localized and potential impacts to Rock Creek would depend on stockpile location. Soil eroded from disturbed sites and stockpiles may move far enough to be deposited as sediment to floodplains and streams. Increased sediment loads in turn may adversely affect water quality and fisheries (see Hydrology and Aquatics/Fisheries).

Apart from erosion resulting from steep slopes and exposure, each stockpile would have a different potential for erodibility. Each stockpile includes soils from adjacent or nearby salvage areas (see **Table 2-3**), thus the nature of each stockpile would be different in terms of soil texture and rock content. Soils salvaged at the exploration adit site would be salvaged in two lifts and stored separately. The surface lift, which includes the more suitable soil, would be comprised of volcanic ash-influenced, very gravelly and cobbly silt loams and loams. The second lift would be comprised of extremely gravelly and cobbly silt loams. Due to the high angular rock content, these stored soils would have a low-to-moderate erodibility potential.

Soil stored in stockpiles 1 and 2 would be dominated by volcanic ash-influenced loams and silt loams mixed with a relatively low percentage of gravelly loams and gravelly sandy loams. In addition, Stockpile 1 would contain a large amount of silty clay loams. These stockpiles would have a high potential for erodibility (Kuennen and Gerhardt 1984). Where rock content was higher and of an angular nature, potential erodibility would decrease. However, less than 30 percent of the stored volume in theses stockpiles would be rocky.

Stockpiles 3 and 4 would be located in the proposed facilities area. Soil stored would consist primarily of ash-influenced, gravelly sandy loams. These stockpiles would have a high-to-very- high potential for erodibility (Kuennen and Gerhardt 1984).

Soils salvaged along new roads, tailings corridor, and miscellaneous disturbances would be stored adjacent to the disturbance area. These soils are locally variable. Most are ash-influenced but textures include sandy loams, gravelly silt loams, and very gravelly sandy loams and loamy sands. These stockpiles would have a moderate to very high potential for erodibility (Kuennen and Gerhardt 1984), however, the size (height) of stockpiles would be small. Salvaging soil from new road construction in steep terrain would result in the need for a much wider corridor and ultimately result in greater soil disturbance and, in turn, erosion and sedimentation. In this situation, the potential benefits of soil salvage and respread on road fills is outweighed by the potential negative effects of greater disturbance.

Erosion would be likely to occur a second time during reclamation activities when salvaged soil was respread on recontoured surfaces. Areas reclaimed using direct-hauled soil (a reclamation technique whereby soil is stripped and immediately placed on the prepared surface), such as on the mill site pad face and fill slopes of roads, would have less potential for erosion than areas reclaimed with stored soil. Protective vegetation would establish more quickly because direct-hauled soil is still biologically active (see Biological Activity) and retains a higher level of favorable physical and chemical characteristics. However, only a small undetermined percentage of the total volume proposed for salvage would be handled this way. Soil losses during salvage and replacement activities could affect the volume of soil estimated for salvage, in turn affecting proposed redistribution depths (see Reclamation).

ASARCO's proposed measures to control runoff and sediment (see Chapter 2) combined with native topsoil and subsoil characteristics, such as rock fragment content, would help reduce erosion rates. Until vegetative ground cover reached predisturbance levels (3 to 5 years), however, erosion rates would be higher than before disturbance. Impacts on aquatic life from erosion and sedimentation are discussed in Aquatics/Fisheries.

Physical Characteristics. Physical properties of respread soil in the reclaimed areas would be very different from conditions before disturbance. Handling would result in the loss of the natural soil profile developed over 10,000 years, compaction (destruction of pore space continuity and soil structure), and a loss of organic matter due to mixing and dilution. Aeration and bulk density changes would adversely affect soil-plant relations due to decreased soil water-holding capacity and aeration, and increased bulk density. Where rock content of respread soils was greater than 15 percent, these impacts would be somewhat offset.

Soils should be handled at the optimum moisture content to reduce the risk of compaction of salvaged soil. The volcanic ash component of many of the soils proposed for salvage may provide some resistance to severe compaction caused by equipment operation and the sheer weight of the stockpiles. Volcanic ash-influenced soils in northwest Montana have lower initial bulk densities than soils derived from other sources. When disturbed during activities that used heavy equipment (such as logging), these soils would compact but not as severely as other soils (Kuennen, Edsond, and Tolle 1979). The reasons for this are not well understood, but they appear to relate to the porous nature of ash particles, how they naturally aggregate, and how they interact with organic matter (Harwood and Youngberg 1969; Nimlos 1981). On the other hand, studies have not explored the behavior of ash-influenced soils under prolonged storage in deep piles, so it is not possible to quantify the potential benefits these soils may have in resisting compaction.

ASARCO proposes standard reclamation techniques, such as discing and ripping, on slopes less than 33 percent, to prepare the recontoured surfaces for soil redistribution and also for seedbed preparation. These practices would tend to offset compaction on many reclaimed sites. Some areas, such as the mill site pad face and road fills, would receive direct-hauled soil. If seeded immediately, and provided that soils are handled when they dry, compaction would be of minimal concern.

The establishment of vegetation and physical processes (such as freezing and thawing) would increase soil-building processes. In time, impacts related to poor physical characteristics of respread soils would be reduced (see Reclamation for additional detail by disturbance area).

Soil moisture stress in reclaimed areas may only limit plant growth for short periods in normal years because precipitation is usually balanced by or exceeds evapotranspiration (see Chapter 3, Climate). Soil moisture problems most likely would be expected for reclamation of the tailings impoundment, especially the dam faces. The combination of replacing a shallow layer of silty clay loam soils over well-drained tailings on the steep south- and west-facing aspects would result in hot, droughty conditions.

Soil Biological Activity. Biological impacts would occur in most salvaged soils. Because most of the disturbances could not be reclaimed until the end of operations, it would be necessary to stockpile most of these salvaged soils for 30 years or more.

Prolonged storage decreases or eliminates populations of important soil microorganisms such as bacteria, fungi, and algae, which are essential in soil nutrient cycling (Miller and Cameron 1976). In addition, some favorable components normally found in native soils are lost through decomposition during storage. These components include seeds of native plants, rhizomes (underground stems), and other plant parts capable of producing new plants. Replenishment of these organisms would occur with interim revegetation but would be limited to the surface (the top 6 to 8 inches) of the stockpile. Thus, the vast remainder of stockpiled soil would have reduced biological activity.

Mycorrhizae (important structures that develop when certain fungi and plant roots form a mutually beneficial relationship) are also eliminated in soil stored for prolonged periods. Mycorrhizae serve as highly efficient extensions of plant root systems, especially for woody species. These associations are important to consider in maximizing plant establishment and productivity, since most plants depend on mycorrhizae for adequate growth and survival (Mallock, Pirozynski, and Raven 1980; Trappe 1981). This is especially true in nutrient deficient soils (Harley 1969). These structures are particularly important to plant phosphorus nutrition and water uptake (Christiansen and Allen 1980). Thus, the association of mycorrhizae with plants in the study area is especially critical since plant-available phosphorus is low.

The loss of mycorrhizae could lower plant species diversity (Reeves et al. 1979). Mycorrhizae would invade reclaimed sites from adjacent undisturbed areas, and species diversity would eventually increase. No large-scale field method exists for the artificial establishment of mycorrhizae in soils of disturbed sites; however, it is possible to inoculate tree-planting stock with the appropriate mycorrhizal fungi.

ASARCO has not proposed any methods to restore or accelerate the recovery of soil biological activity. Therefore, the survival and growth of woody species, in particular, may be reduced.

Soil Nutrients. As is typical of many forest soils, nutrient levels in the study area soils are low to very low partially due to low soil reactivity (pH). During soil storage, these levels would only decrease as biological activity decreased and precipitation leached nutrients through the stockpiles. Coniferous forest debris in stockpiles can further decrease soil pH as the material weathers. (Liming can minimize this effect but ASARCO has not proposed it.) Until vegetation became re-established and soil building processes began again on reclaimed areas, inadequate nutrient status would continue to be limiting.

This is particularly true with phosphorus, which is an essential plant element. Soils formed in volcanic ash often fix phosphorus in a form unavailable for plant uptake (Jones et al. 1979). Organic matter in the upper few inches of native soils acts as a reservoir for phosphorus. Plant-available phosphorus is released by microbial decomposition within and directly (1 inch) below the forest litter layer (Lou Kuennen, Kootenai National Forest, personal communication, January 13, 1989). Respread soils would lack organic matter, as explained above, therefore, surface applications of soluble phosphorus fertilizer at the time of seeding, as proposed by ASARCO, may be of little value.

ASARCO proposes to determine other fertilizer requirements at the time of soil redistribution and to apply fertilizer at the time of seeding and in the season following seeding. This would further help reduce low-nutrient impacts.

Metal Contents in the Reclaimed Rooting Zone. Metals such as aluminum, iron, and manganese are common in native forested soils in the area. They are common metals released by the weathering of soil parent materials, even in nonmineralized areas. These metals can become concentrated in a particular soil horizon by various soil-formation processes. They usually are not available to plants at neutral reaction (pH) values. However, if soil surveys indicate soil pH is around 5.0, the Agencies require soil metal testing to identify possible naturally occurring concentrations of these and other metals. Most soil samples tested had pH values between 5.1 and 6.5. Several samples had pH values between 4.5 and 5.0. Samples with low pH were found at all proposed disturbance areas.

Soil samples in the study area were tested for a number of heavy metals that often are associated with mineralized zones and could hinder plant growth. These included lead, zinc, nickel, molybdenum, copper, aluminum, antimony, arsenic, and cadmium. With the exception of aluminum, the levels of each were near or below instrument detection limits. Aluminum was slightly elevated (0.9 to 3.4 parts per million, or ppm) in some study area soils proposed for salvage, particularly those derived from volcanic ash-rich loess over lacustrine deposits. These aluminum levels are common in forested soils of northwest Montana.

Native vegetation of the study area would be expected to be adapted to the ambient soil chemistry characteristics, including elevated aluminum levels. However, since many of the grass and forb species proposed in ASARCO's revegetation seeding mixes are not native or locally adapted, limited phytotoxicity may be a concern to reclamation success. McLean and Gilbert (1927) showed that timothy (a grass species proposed in ASARCO's interim and final revegetation seed mixes) is sensitive to aluminum at levels as low as 2 ppm. On the other hand, timothy occurs in the drier communities identified in the permit area (Scow, Culwell, and Larsen *In* ASARCO, Incorporated 1987-1994) and has been used successfully in revegetation mixes for road cuts on the Kootenai National Forest (Lou Kuennen, Kootenai National Forest, personal communication, November 17, 1994). The elevated aluminum levels may not accurately reflect the levels that would be available for plant uptake due to peculiarities of volcanic ash chemistry and testing procedures. ASARCO has committed to identify nutrient/phytotoxicity problems in the event of poor germination and/or growth.

Seeps from other soil stockpiles in forested regions of Montana have elevated levels of iron and manganese. The levels of tannic acid are increased and soil pH is thereby reduced due to the breakdown of coniferous forest vegetation in the stockpiles (Pat Plantenberg, Department of State Lands, personal communication, July 19, 1994). Low pH and increased levels of iron and manganese can result in complex nutrient deficiency and/or phytotoxicity problems in many plant species (Knezek and Ellis 1980; Kabata-Pendias and Pendias 1984.) Reduced plant growth and/or mortality would slow or severely impair reclamation. Applications of composted organic matter has helped to improve plant growth on reclaimed sites with affected soils (Vodehnal 1993). Applications of lime are being used to increase pH. Without these amendments, plant growth has been limited (Pat Plantenberg, Department of State Lands, personal communication, February 8, 1995).

The geochemical nature of waste materials generated during the mining operation were evaluated to determine whether they would pose problems for plant growth. The waste rock dump would be composed primarily of non-ore bearing stones and cobbles. Testing showed that this material has low leachable levels of metals (metals that would become soluble in soil water) that could affect plant growth (ASARCO, Incorporated 1987-1994).

Tailings would consist primarily of fine sands and silts. Preliminary testing shows these materials are not potential sources of acid generation and that they have generally low levels of leachable metals (metals that would become soluble in soil) that would be available to and potentially harmful to plants (see Hydrology).

Considering these results, the waste materials would have no potential adverse chemical impacts on respread soil or on plants whose roots may grow into these materials. ASARCO would test waste rock and tailings prior to soil redistribution to reconfirm these results.

Reclamation Impacts

The goals of reclamation serve a number of purposes as described in Chapter 2. **Tables 2-1, 2-3, 2-12, and 2-13** provide summary information on proposed disturbance and soil salvage acreage, revegetation approaches, postmining topography, and reclamation timing for all action alternatives. The discussion below focuses on soil handling and revegetation and the degree to which successful reclamation may be achieved.

Soil Salvage and Handling. The potential for reclamation success of disturbed lands is greatly improved when soil is salvaged and later replaced as a growth medium for plants. The primary limitations that affect soil suitability for salvage and reclamation at the Rock Creek Project include steep slopes, rock content, and texture. Salvage may be limited for soils with more than a volume of 50 percent hard rock fragments (larger than 1/16 inch diameter) or with large rocks (greater than 2 feet in diameter). Salvage is usually not required and not conducted on slopes exceeding 2:1 (50 percent) because of worker safety. Other reclamation limitations at the Rock Creek site include soils with high clay content, low fertility, low organic matter content, elevated aluminum concentrations where pH values are below 5.0, and nutrient deficiencies or toxicity problems if stored soils create acidic conditions.

To minimize compaction problems, soil would be handled only when the tilth is good and stored soils would not be disturbed again until respreading was scheduled. Surfaces to receive soil would be ripped to increase root penetration potential and to decrease slippage potential.

Concerns have been expressed about the depth of soils needed to reclaim proposed disturbances such that reclamation would achieve the goals of comparable stability and utility. The tailings and waste rock are essentially inert and should not geochemically inhibit plant growth. Research generally has shown that replacement of 24 inches of soil over suitable mine waste rock would produce maximum revegetation (Coppinger, Ogle, and McGirr 1993). Depending upon the postmine land use, and availability of suitable salvageable soils, less soil may produce acceptable results. However, proposed soil replacement of 13 inches or less is probably inadequate. These depths likely would reduce successful revegetation, especially in areas where soils are naturally deeper (i.e., at the mill site and disturbed riparian zones).

At the exploration adit, 8.3 acres are proposed for disturbance. Soils proposed for salvage have an ash-influence and have a very high rock content. Soil would be salvaged from 4.2 acres (Lift 1); that portion that is not rock outcrop or talus. Where soils are deeper within this acreage, a second lift soil would be salvaged from 2.0 acres (Lift 2). Soil would be respread in two lifts to an average depth of 13 inches on 4.9 acres. The double-lift salvage and replacement provides for enhanced soil physical and chemical properties in the reclaimed surface soil layer, because Lift 1 soils have more favorable conditions such as higher organic matter content. This practice salvages and then restores some of the natural soil profile that developed on the site since the last major climatic change. The remaining soil would cover about 1.4 acres on the waste rock dump face. The rest of the area would be left as talus-like rock fingers.

The proposed support facilities area for the exploration adit is located in Section 22 along Rock Creek. The disturbance area would be about 1.3 acres (see **Table 2-1**). Soil salvaged from parking lots and building sites would be minimal and stored adjacent to facilities. Soil would be respread and revegetated after the facilities were removed. (Dave Young, ASARCO, Incorporated, in a letter to Kathy Johnson, May 16, 1994.)

Total proposed disturbance for the tailings impoundment area is 388.9 acres. The effective rooting depth for the native soils in this area varies between 18 and 33 inches, extending below the ash-influenced loess surface into the clay-rich subsoil (Noel *In* ASARCO, Incorporated 1987-1994). However, the clayey subsoils (below 11 inches), which are poorly suited as a surface plant growth medium, were not proposed for salvage (Noel *In* ASARCO, Incorporated 1987-1994). ASARCO proposes a soil replacement depth of 9.5 inches. Most of these soils would be spread over the tailings impoundment (324 acres). The tailings material would be composed of fine sands and silts that would not be phytotoxic (lethal or damaging to plants). However, it is very likely that this material, especially the silts, would become very hard and compacted upon drying. Without scarification or deep ripping before soil placement, this fine tailings material could become an effective barrier to root penetration. Tailings on the dam face would be coarser and likely would not become a physical rooting barrier. However, a soil moisture differential may be created by two contrasting materials (soils and coarse tailings).

Soils stripped from the borrow area 2 and 3 would be stored and then replaced during the 3-year predevelopment period. Because of the relatively short soil storage time, these sites would stabilize and approach premining productivity levels more quickly than other areas. Borrow area 3 would be used as a wetland mitigation site (see Wetlands). If possible, soils from impacted wetlands within the impoundment footprint would be used to reclaim borrow area 3.

The total disturbance acreage for mill facilities and mine areas would be 78.8 acres. Salvageable soil depths in the mill site average about 21 inches. This depth corresponds to the ash-influenced loess surface and is where plant roots are concentrated. Substratum materials apparently provide little in terms of nutrients and normal water requirements for plants. Because the rock fragment content and slopes often exceed 50 percent in the mine and waste rock dump area, ASARCO has not proposed salvage in this area. ASARCO proposes to respread salvaged and stored soils from the mill site area over the mill site, mine, and waste rock dump areas. The average replacement depth would be 11.4 inches. As mentioned, this depth would be considerably less than the average topsoil depth for native soils in the facilities area. A substantial loss in existing productivity in the facilities area, which is important wildlife habitat (see Chapter 4, Biodiversity), would be expected. Vegetation (primarily trees) would be stunted and less vigorous because root volume (soil depth) would be reduced and soil horizons would be mixed. Further, it is not likely that spreading 21 inches of soil from the mill site area over all these disturbance areas to a depth of 11.4 inches would produce additional productivity increases to offset the impact of less soil at the mill site.

Soils along the transportation corridors (access roads, slurry line, powerline) would be stripped from about 29.3 acres and stored adjacent to the disturbance.

Impacts resulting from soil salvage and handling would be moderate in the short term and moderate to minor in the long term for aesthetic considerations and comparable stability and utility determinations. The effects would be the most obvious on the reclaimed tailings impoundment area and the facilities and mine site areas. This is largely because soil depth would limit productivity and reclamation success.

Revegetation. The main issues relating to revegetation include scheduling of final revegetation, species selection, planting plans, establishment success, and growth rates to achieve cover and height objectives. These factors determine the speed and success of restoring the disturbed lands to comparable stability and utility.

ASARCO would not implement final reclamation for most disturbances until the postoperational phase (years 34 and 35). Final reclamation would be done on some sites during the predevelopment period (years 1 through 3). These areas would include the borrow areas, the primary access road and new public road in the facilities area, and the waste rock dump. Final reclamation would be ongoing during predevelopment and operation (years 4-33) for soils stockpile sites, other roads, and the tailing impoundment dam face (see ASARCO Reclamation Plan *In* ASARCO, Incorporated 1987-1994 and **Table 2-13**).

Trees may be planted throughout the project life as areas are reclaimed. ASARCO would plant trees at the end of operations on the facilities and mine areas and on the tailings impoundment face and top. ASARCO predicts it would take 15 years for the tailings impoundment to be fully drained and for the entire tailings impoundment surface to be workable. Some areas would be workable within 1 year, as experience has shown at the Troy Mine. Reforestation of the transportation corridor and exploration adit area would occur by natural regeneration. Foregoing or delaying tree planting may reduce success of establishment, and result in lower growth rates. Also, visual screening of and restoration of wildlife habitat on disturbed areas would be delayed (see Scenic Resources and Biodiversity).

ASARCO has developed three final seeding/planting mixes to accommodate the differences in disturbance areas (see **Table 2-13**, **Appendix G**, and ASARCO's Reclamation Plan (ASARCO, Incorporated, 1987-1994)). Grasses (primarily introduced species) and forbs are the same for all three mixes with the exception that alsike clover would not be planted on the road corridors or at the facilities and mine area until after operations to discourage wildlife use that could interfere with traffic and other operations.

Shrub revegetation would be done on some but not all reclaimed areas. In the tailings impoundment area, shrubs would be seeded except on the dam face where they would be planted at the end of operations. In the facilities and mine areas, shrubs would be seeded. In the transportation corridor, shrubs would be planted on road cut-and-fill slopes, only as necessary to enhance slope stability. Seeded shrubs would take longer to establish than planted shrubs so wildlife habitat and visual screening objectives would be delayed. For the remaining disturbance areas, ASARCO is depending on natural invasion of shrubs from adjacent undisturbed areas. This practice would further slow visual screening and wildlife habitat objectives.

Proposed revegetation of the exploration adit includes seeding only grasses. Trees and shrubs would not be seeded or planted. ASARCO would rely on invasion and establishment from surrounding undisturbed areas. This approach would increase the time needed to achieve a natural-looking setting, and provide screening and important wildlife habitat forage components in the short term. A well established grass cover in this area would likely retard the establishment of volunteer trees.

For the tailings impoundment area, ASARCO has proposed two tree planting mixes. Douglas-fir and ponderosa pine would be planted (in a 50/50 proportion) on the dam faces. Douglas-fir, western white pine, western larch and lodgepole pine would be planted in a ratio of 40:20:20:20 on the impoundment surface and associated areas. Species selection and stocking rate (665 trees/acre) is appropriate for undisturbed site conditions attempting to meet stated reclamation goals for timber stands. The Agencies believe this species mix would not perform well on reclaimed areas due to the site conditions. The dam face would be a particularly harsh growing site because it would face west and south; a hot, dry exposure during the late spring and summer months. (Margaret Lincoln, Kootenai National Forest, in a memo to Pam Hackley, March 30, 1995; and a number of personal communications between Pam Hackley and Margaret Lincoln, Lou Kuennen, Dan Leavell, Kootenai National Forest, May 25, 1994 through April 24, 1995).

Tree height growth rate and ultimate tree height is influenced by a number of factors, including species, site productivity and competition (Smith 1962). Under the most favorable conditions, it would take 15 to 30 years for planted trees on the dam face to reach heights of 20 to 40 feet. Even assuming good survival and establishment of seedlings, replaced soil would be deficient in physical and biological characteristics, discussed above, necessary for optimum growth conditions. Tree establishment on the impoundment surface would be successful initially because replacement soil and site conditions would be suitable for tree growth. However, without ripping of the tailings before soil placement, tree root growth would be hindered at the tailing-soil interface within 5 years. Overall growth rates likely would decline, in most part due to decreases in soil water availability and compaction. Root systems would continue to grow and even penetrate the substrate, but the mass of roots would be concentrated in the upper foot of soil, resulting in slow-growing, possibly stunted trees over time.

This shallow rooting could also affect reclamation success on the tailings impoundment dam face but to a lesser degree than on the impoundment surface. Volunteer trees growing on the lower portion of the Troy Mine impoundment face have shallow root systems that spread along the contact between respread soil (3-12 inches deep) and the tailings. (Pat Plantenberg, Department of State Lands, personal communication, July 19, 1994). If similar conditions prevailed on the proposed Rock Creek impoundment face, trees would be likely to develop shallow root systems, resulting in possible stunted tree growth and blowdown during high wind events. This combined with the hot, dry exposure would greatly limit planted tree growth rates. Trees at year 30 may be only 10 to 25 feet (M. Lincoln et al., pers. comm., May 25, 1994 through April 24, 1995).

For the facilities and mine sites and associated disturbances, ASARCO proposes a tree planting mix of larch, spruce, lodgepole pine, and Douglas-fir in a proportion of 20:20:20:40. Stocking rate would be 665 trees per acre. Planting would occur at the end of operations. Although this mix may meet restocking goals for timber on less disturbed sites, it may not meet overall wildlife or scenic resource goals as identified by the Agencies (M. Lincoln et al., pers. comm., May 25, 1994 through April 24, 1995).

The proposed planting plan includes planting trees in 2-to- 4-foot wide strips (6-by-6-foot spacing) interspersed with strips of seeded grass. Trees would only be planted on slopes less than 3:1 (33 percent). This arrangement would not match surrounding landscape features and thus would not meet visual quality objectives (see Scenic Resources).

ASARCO's proposed soil testing program to identify fertilizer and other possible soil amendment needs would minimize plant-nutrient deficiencies and would improve growth rates and, in turn, revegetation success. Results of the proposed revegetation program, especially the shrub and tree planting plan, would extend the time needed to meet visual screening and comparable stability and utility objectives in the short term.

Alternative III

Soil Impacts

Proposed changes to ASARCO's mine plan would result in an overall increase in disturbance area of 10 acres. Access road mileage in the transportation corridor and public road mileage in the facilities area would increase but disturbance associated with the utility and tailings corridor would decrease. Although the overall disturbance acreage would increase under Alternative III, the proposed mitigation measures should result in less erosion overall. This, in turn, would result in less chance for sedimentation to Rock Creek.

Interim seeding would be conducted as soon as possible (regardless of season) after disturbance and on all stockpiles as they were built. This would reduce erosion potential greatly (Lou Kuennen, Kootenai National Forest, personal communication, February 26, 1990). Similarly, final seed mixtures would be planted as soon as possible after site preparation occurred. Stockpiles may require additional protection measures, such as mulching where salvaged materials warrant.

Disturbances associated with the Miller Gulch siding would be minimal. The bridge replacement increases the chances for erosion and sedimentation in Engle and Rock creeks. However, the nearly perpendicular alignment would disturb less area and the bridge structure and fill slopes would be less susceptible to erosion and washout than with a skewed alignment. Additional BMPs and construction monitoring would be implemented and the extent and timing of construction would be required as part of the special use permit issued by KNF (see Transportation). To further minimize erosion, a vegetation management plan would be developed to reduce disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments.

Other modifications of soil handling, reclamation, and revegetation plans discussed in Chapter 2 would preserve more of the native soil characteristics that have developed on the site over the last 10,000 years. Two-lift salvage in the impoundment area and mill site would help reduce the impacts to soil physical, biological, and chemical properties discussed in Alternative II.

Reclamation Impacts

The overall reclamation plan would be reassessed and updated with the Agencies' approval, to provide for a balance of resource needs, such as soil stabilization, reclamation success, biodiversity and scenic resources. Suggested changes to ASARCO's reclamation and revegetation plans are described in **Appendix G** and Chapter 2.

Soil Salvage and Handling. Reclamation would be enhanced by salvaging soils to greater depths and segregating/respreading soil based on quality of horizons. Increasing respread depths to 24 inches would increase tree growth rates by providing suitable soil volumes for root systems (Armiston 1968; Berndt and Gibbons 1958; Cox, McConnell, and Matthew 1960; and McMinn 1963). Reclamation of the relocated waste rock dump into two smaller dumps adjacent to the facilities area likely would be more feasible. Soils would be salvaged to a greater depth (36 inches) and in two lifts from the facilities area (stored in TP 3 and 4) and some soil would be salvaged from about 3 acres (slopes about 40 percent) of new dump locations and stored along the sides and bottom edge (total additional volume about 82,981 cubic yards). Soil could be respread on the two relocated mine waste rock dumps more effectively and would make the sites more suitable for plant growth. Similarly, the proposed changes in the exploration adit dump configuration would result in more effective use of salvaged soil. Reclamation of the tailings impoundment area would also require a greater salvage volume (in 2 lifts [total additional volume about 685,090 cubic yards]; additional storage acreage needed at TP 1 [about 8 acres] and 2 [about 8 acres]) to ensure a respread depth of at least 24 inches. Soils would be salvaged (about 4,195 cubic yards from 1.3 acres) at the exploration support facilities location in Section 22 and respread to a depth of 24 inches. Soil salvage along new roads is recommended only where terrain is suitable and where salvage provided clear benefits for revegetation.

Soil stockpiles would be amended with lime and organic matter would be incorporated to ensure that poor quality seeps do not develop and overall quality of soil is not additionally affected.

Linear features, such as benches on waste rock dumps and the tailings impoundment crest, would be altered and other recontouring would be conducted to more closely resemble natural features. Reclamation and planting of the tailings impoundment face would begin in year 8, after the starter dam was completed. Interim mulching would reduce erosion from the lifts until regrading, respread of soil, and planting were accomplished. Every 3 or 4 years, as the tailings impoundment grew taller (e.g., every 25-30 vertical feet or whatever is practical for large machinery to maneuver for recontouring and planting), a new strip would be graded and planted (see Scenic Resources).

These changes to the reclamation plan would decrease concerns about plant root growth into compacted tailings and enhance tree and shrub growth rates. In turn, the goal of reclaiming the site to comparable stability and utility would be more closely achieved. The Agencies also would require monitoring of soil replacement depths, re-evaluation of soil handling to maximize direct-hauled soils, and identification of other techniques to minimize length of time soil was stored.

Revegetation. The overall revegetation plan would be updated to better meet the Agencies' concerns for rapid soil stabilization, restoration of soil productivity, early screening, and species establishment and diversity (see **Appendix G**). Grass and forb seed mixes and tree and shrub plantings would be reassessed to address site specific objectives. Modifications include:

- selecting species that consider plant succession and environmental conditions of recontoured areas to best achieve overall watershed and habitat conditions; for example, select a mix dominated by seral (tree) species adapted to harsh or disturbed sites;
- developing a revegetation plan to specifically address disturbances and revegetation of the transportation corridor;
- conducting interim seeding immediately, as discussed above, on all disturbances to decrease the potential for noxious weed invasion;
- accelerating final revegetation by planting trees and shrubs as soon as final contours were reached; planting shrubs and trees in mosaics that resembled the surrounding visual landscape;
- testing substrate (tailings, waste rock) and stockpiled soil chemical and physical conditions to identify fertilizer, liming, and other soil amendments that may be necessary to ensure adequate plant growth;
- choosing species that met short-term needs to stabilize soil but would not be attractive to wildlife;
- selecting species that met long-term needs for wildlife including browse, forage and cover, and arrangement of wildlife habitat components in the Rock Creek watershed (travel corridors, snags, winter range);
- collecting seed from the permit area and propagating seeds and plantings to ensure locally adapted and genetically compatible stock;
- choosing rapidly establishing grasses that would not hinder native colonization or that would spread off the reclaimed area (eliminate species such as timothy);
- choosing locally native pioneer species (such as fireweed and pearly everlasting) for rapid stabilization;
- hand planting trees and shrubs on slopes exceeding 33 percent;
- protecting seedlings from wildlife browsing until trees grew above browsing height;
- using shade cards or other techniques to protect planted seedlings;

- using stockpiled slash (greater than 3 inches) to provide shading and precipitation catchments;
- using chips, sawdust, logging debris, or other organic amendments to help build soil organic matter; identifying carbon/nitrogen ratios;
- inoculating tree and shrub seedlings with appropriate mycorrhizal fungi;
- inoculating legume species (clover and ceanothus) with appropriate nitrogen-fixing bacteria; and
- using drip irrigation April through early June only for 1 to 3 years to help establish trees and shrubs on the tailings impoundment face and to avoid the need for replanting.

These changes in planting strategies and species selection would result in a marked improvement in revegetation success and in restoring soil productivity as quickly as possible. This, in turn, would better meet visual quality and habitat goals.

Alternative IV

Soil Impacts

Impacts to the soil resource would be the similar to those identified under Alternative III, with the following exceptions. Relocation of the mill and adit site facilities and associated reductions in road, utility, and powerline corridor lengths would result in an overall decrease in the disturbance area of about 41 and 66 acres, respectively, in comparison to alternatives II and III. Mine waste rock would be used for mill pad construction and starter dike material thus eliminating the need for a dump. Soil loss due to erosion would be greatly reduced since road length would be reduced. Where possible, a 300-foot vegetation buffer would be maintained between Rock Creek and the mill site, new construction in the transportation/utility corridor, and in borrow site 3 where a replacement wetland would be developed. If soil eroded off-site, this buffer would more effectively filter sediment before it could reach Rock Creek.

Reclamation Impacts

Improvements to the reclamation plan would also be similar to those identified under Alternative III. Soil salvaged from the confluence mill site would total about 151,665 cubic yards. It would be salvaged in two lifts (lift 1 = 19 inches, lift 2 = 6 inches). Respread depth would be about 24 inches. Soil salvage and respread would be easier and more efficient due to the site configuration and gentler slopes. In turn, revegetation is likely to be more successful.

Reclamation and planting on the mill pad faces would occur immediately after construction, and soil respread such that screening would occur early in the project life.

Cumulative Impacts

Cumulative impacts to soils primarily would be associated with potential soil loss. Erosion would increase in the Rock Creek drainage by some unknown amount as a result of proposed Forest Service and possible private timber harvests, new road construction, and possible commercial and residential development. Increased erosion may result in increased sediment rates to Rock Creek and the Clark Fork River. KNF requires the implementation of BMPs during logging and road-building operations. If these practices were properly implemented and maintained, on-site erosion and, in turn, potential increase in sedimentation to Rock Creek would be minimized. More acreage would become unproductive due to increases in roads and paved or graveled surfaces, however this additional loss is not expected to affect overall productivity in the region.

HYDROLOGY

Summary

The proposed adits, underground mine, mill facility, utility corridor, waste rock dump, and the tailings impoundment would have the potential to affect surface and ground water resources under all action alternatives. Hydrologic effects would include changes in water availability and water quality.

Total ground water inflow to the exploration adit is estimated to be about 168 gpm. Inflow to the conveyor and service adits would be about 228 gpm. Inflow to the underground mine is estimated to be about 1,650 gpm. Total inflow to the underground workings and adits would equal about 2,046 gpm. The quality of mine inflow would be affected by blasting activities; concentrations of nitrogen, ammonia, suspended solids, and metals would increase. Excess mine water would be temporarily stored underground, and would be treated to remove suspended solids, metals, and nitrogen prior to discharge via a pipeline to the Clark Fork River. The impact of treated discharge on the quality of water in the Clark Fork River in Montana and Idaho would not be measurable due to the low concentration of constituents in the treated effluent and the relatively higher flow available for dilution. After mining had ceased, excess mine water would continue to be treated until it eventually met state discharge standards.

Two wilderness lakes in the CMW overlying mined-out portions of the mineral deposit could potentially be affected if faults or fractures acted as ground water conduits, and ASARCO's pilot hole testing and grouting programs were ineffective. As a result, water levels in lakes and surface outflow from the lakes might be reduced. The potential for this to occur is remote. The Agencies' requirement for additional rock mechanics studies in alternatives III and IV would further reduce the risk of subsidence-related draining of these lakes. Water occupying fractures in rock above the operating level of the mine could be lost to mine inflow.

After mining was complete and the adits were sealed, the mine would fill with water until steady state conditions were reached. At steady state, inflow to the mine would equal outflow. It is uncertain where outflow from the mine would discharge. If access adits were not sealed, excess mine water could be discharged to surface waters.

Make-up water from a well located in the Clark Fork River alluvium near the confluence with Rock Creek would be required if mine adit and tailings reclaim water could not provide all water needed to maintain mill operations. The impact of the proposed withdrawal would not significantly affect existing instream flows or existing beneficial uses of the Clark Fork River or ground water.

Ruptures or breaks in either the proposed tailings slurry or return water lines, or an accidental rupture of a supply or tanker truck could result in short-term water quality impacts to Rock Creek. The potential of tailings pipeline ruptures and spills in the West Fork of Rock Creek are eliminated under Alternative IV. The effect that either event would have on the overall water quality of Rock Creek cannot be predicted with certainty.

Depending on weather conditions and the efficiency of best management practices used, sediment and nitrogen loading to Rock Creek below the proposed mill site could temporarily increase during project construction. The concentration of total suspended solids (TDS) in Rock Creek would probably not exceed 20 milligrams per liter (mg/L). The amount of sediment would be reduced under alternatives III and IV due to mitigations, including reduction of existing sediment sources in the drainage. The increase in the concentration of nitrogen in Rock Creek cannot be estimated with certainty, and would depend on several factors. Research suggests that the impacts of leaching soluble nitrogen in waste rock would be short lived. All nitrogen compounds would probably be leached out within one month to one year (British Columbia Ministry of the Environment 1983).

Development of the proposed tailings impoundment would remove more than 300 acres of natural watershed in the Miller Gulch drainage. Surface water runoff in Miller Gulch would decrease during the life of the project, and would likely return to near normal after reclamation.

Seepage from the proposed tailings impoundment to ground water within the ground water mixing zone could approach several hundred gpm by the end of the 30-year mine life. Seepage water quality from the impoundment would likely be similar to impoundment seepage water quality at the ASARCO Troy Mine, and would affect ground water quality within a ground water mixing zone permitted by DHES (see [ARM] §16.20.1802(6) for the definition of a mixing zone). An engineered perimeter drain and ground water extraction well system would pump seepage water back to the tailings impoundment, and would prevent changes in ground water quality outside of the mixing zone, or would prevent discharge of tailings impoundment seepage to Rock Creek, Miller Gulch, and the Clark Fork River. Continued monitoring of a series of tailings impoundment compliance wells would minimize or possibly eliminate the potential for seepage to migrate outside the mixing zone.

After the tailings impoundment was reclaimed, seepage from the impoundment would decrease, and the impoundment would dewater over several decades. Therefore, the perimeter seepage collection system would potentially need to be operated and maintained, and ground water would be monitored for several decades for all action alternatives.

Sediment and tailings leachate would be uncontrollably released to the environment in the unlikely event of catastrophic failure of the tailings dam under any action alternative. The volume of material released and the effect of this release on the environment cannot be predicted, and would depend on the *type of failure, the size of the tailings impoundment at the time of failure, the volume of water associated with the failure, and the initial volume and character of the sediments. During a failure, sediment and tailings water could flush into Rock Creek and the Clark Fork River. Portions of this sediment mass would probably remain in these stream channels for an undefined period of time following failure, while tailings water and the remaining sediment would be carried downstream. Subsequent to any such failure seasonal high flows would continue to wash most of the remaining sediment downstream, and eventually the sediment would be stored in Cabinet Gorge reservoir upstream of the dam. Fine sediments from any such catastrophic failure would probably persist in the Rock Creek system for decades. Tailings water and sediments would eventually enter Lake Pend Oreille. Because of the volume of the lake water available for dilution, it is unlikely that changes in concentrations of dissolved or total recoverable metals, or nutrients would be measurable in the long term. Short-term effects temporarily could impair some beneficial uses such as domestic water supply.*

Introduction

Water Quality Standards

Montana's surface water standards, shown in **Table 4-6**, are a combination of drinking water, aquatic life, and water and fish ingestion numeric standards (Circular WQB-7 7/15/94 edition) and the prohibitions discussed in ARM §16.20.633. In implementing these standards, DHES requires analysis of total recoverable metals. DHES will base effluent limits and other conditions of the ASARCO Rock Creek Montana Pollutant Discharge Elimination System (MPDES) permit on protection of beneficial uses and promulgated water quality standards necessary to protect those uses. Designated beneficial uses include potability for public water supply; growth and propagation of salmonid fish and associated aquatic life; wildlife; agriculture; recreation; and industrial supply. A Total Maximum Daily Load (TMDL) calculation would be required because Rock Creek is listed as a water quality-limited stream. The permit effluent limits may serve as a basis for Waste Load Allocation (WLA), a portion of the TMDL process, however, the issuance of a discharge permit does not require that a TMDL be completed.

For ground water, the applicable standards are the primary drinking water standards established by the EPA under the Safe Drinking Water Act or Montana standards, whichever is lower (see **Table 4-6**). In implementing these standards, the DHES requires analysis of dissolved metals. Ground waters are designated Class I waters and are protected for human consumption, irrigation, livestock, wildlife, and commercial and industrial purposes without treatment (ARM 16.20.1002).

Both surface and ground water in the vicinity of the project are considered high quality waters and are subject to Montana's Nondegradation Policy (75-5-303, MCA). Discharges to high-quality waters are allowed provided that all existing uses of state water are protected and the resultant change in quality is determined to be nonsignificant by the criteria of ARM §16.20.712. In this section, water quality impacts are calculated and compared to existing standards and trigger values, for toxic parameters, which are used to determine if impacts are nonsignificant as per the Nondegradation Rules (ARM §16.20.707(23)). Water quality impacts and comparison to existing standards, and trigger values are used to determine whether or not a given increase in the concentration of parameters is significant or nonsignificant as per the nondegradation rules (ARM §16.20.707 [23]); that is, the maximum allowable increase in concentration.

TABLE 4-6.
Montana and Idaho Water Quality Standards⊕ in Milligrams per Liter (mg/L)

	Montana Ground Water (Dissolved Analyses)		Montana Surface Water^h (Total Recoverable Analyses)		Idaho Surface Water (Dissolved Analyses)
	Water Quality Standard	Trigger Value^t	Water Quality Standard	Trigger Value	Water Quality Standard
pH (SU)	N/A	N/A	6.5-8.5	N/A	6.9-9.5
Total Hardness (as $CaCO_3$)	N/A	N/A	N	N/A	N
Total Alkalinity (as $CaCO_3$)	N/A	N/A	N	N/A	20.0S
Sulfate (SO_4)	N/A	N/A	N	N/A	N
Ammonia (NH_3 as N)¶	N/A	N/A	1.3*	0.01	¶
Total Kjeldahl Nitrogen (as N)	N/A	N/A	N/A	N/A	N
Nitrate and Nitrite (as N)	10	2.5	10	0.01	N
TIN	N/A	N/A	N	N/A	N
Orthophosphate (PO_4-P)	N/A	N/A	N	N/A	N
Total Phosphorus	N/A	N/A	N	0.001	N
Arsenic	0.018	N/A	0.018	N/A	0.0062
Cadmium	0.005	0.0001	0.001^h	0.0001	0.00085^h
Chromium VI	0.10	0.005	0.011^h	0.005	0.01045
Copper	1.0	0.0005	0.010^h	0.0005	0.0085^h
Iron	0.3	N/A	0.3	N/A	N
Lead	0.015	0.0001	0.003^h	0.0001	0.00065^h
Manganese	0.05	N/A	0.05	N/A	N
Mercury	0.00014	N/A	0.000012	N/A	0.000012
Selenium	0.05	0.0006	0.005	0.0006	0.005
Silver	N/A	0.0002	0.003^h	0.0002	0.00255^h
Zinc	5.0	0.005	0.093^h	0.005	0.0791^h

Source: Circular WQB-7 (7/15/94 edition); ARM 16.20, sub-chapter 6; ARM 16.20.1003 et seq.; ARM 16.20.203; and Idaho DEQ 1995.
SU = Standard pH Units
t = Trigger values are used to determine whether or not a given increase in the concentration of parameters is significant or non-significant as per the non-degradation rules ARM §16.20.707(23)
¶ = pH and Temperature Dependent; value shown is calculated for 10°C and pH = 8.0. MT and ID standards are equivalent.
h = Standards based on Hardness = 85.7 mg/L and is the more restrictive of the human health or aquatic life standards.
N/A = Not Applicable
TIN = Total Soluble Inorganic Nitrogen
S = Minimal acceptable value except in waters which are naturally lower
N = Narrative standards (see ARM §16.20 or State of Idaho regulations)
* = Personal communication with Tom Reid, Montana DHES, June 18, 1995.
⊕ = Table values are based on chronic freshwater aquatic life criteria with the following exceptions: (MT and ID) Arsenic - human health criteria; Silver - acute freshwater aquatic life criteria; (MT) Manganese and Iron - human health criteria. Table values are the most restrictive standards of each state. Idaho standards for metals are dissolved concentrations; exceptions are mercury, selenium, and arsenic.

The Idaho Department of Health and Welfare, Division of Environmental Quality, administers Idaho's Water Quality Standards. These standards, along with newly adopted numeric toxics criteria based on the National Toxics Rule, effective August 24, 1994, would be used to evaluate ASARCO's proposed discharge to the Clark Fork River. For substances that Idaho does not regulate by numeric criteria, the EPA 1986 Quality Criteria for Water (Gold Book) values are used, along with other methods, to determine impacts to designated beneficial uses. Designated beneficial uses of the Clark Fork River and Lake Pend Oreille include domestic and agricultural water supply, cold-water biota, salmonoid spawning, and primary and secondary contact recreation.

Idaho standards also designate the Clark Fork River and Lake Pend Oreille as Special Resource Waters. This designation and Idaho's antidegradation policy require that pollutants entering these waters cannot impair a beneficial use of that water. Finally, Section 401 of the Clean Water Act prohibits another state to authorize a discharge which violates a downstream state's water quality standards.

Alternative I

Under Alternative I, impacts to ground and surface water quantity could occur from use of appropriated springs, wells, diversions and instream flow. Impacts to surface and ground water could result from land development activities in the Rock Creek drainage, such as timber harvest and home-building. Sediment-loading to Rock Creek could increase an unknown amount from the present due to road-building and land-clearing from timber harvesting.

Alternative II

The proposed adits, underground mine, mill facility, utility corridor, waste rock dump, and the tailings impoundment would have the potential to affect surface and ground water resources. Hydrologic effects would include changes in water availability and water quality. In response to the Agencies' concerns regarding potential impacts, ASARCO has significantly changed its 1987 application for a hard rock operating permit. These changes include treatment of excess mine water to remove nitrogen prior to disposal in the Clark Fork River, collection of seepage from the proposed tailings impoundment, and locating the proposed makeup water well in Clark Fork River alluvium rather than in Rock Creek alluvium. Water quality effects are assessed in terms of 21 analytes, including 11 metals, five nutrients, and five physical parameters and common ions. These analytes were identified as parameters of concern during Agency review and public scoping processes for this draft EIS. The discussion of ground and surface water impacts for Alternative II is organized according to the facility or operation the potential impact is associated with.

Ground Water Quantity

Exploration Adit. Most ground water in the vicinity of the exploration adit probably moves through fractures and faults. Flow in fractures is controlled by secondary porosity (flow in fractures instead of rock) and the continuity of the fractures. Faults can act as both conduits of or barriers to ground water flow. Because there are no hydraulic conductivity data for the Copper Lake Fault, the rate of adit water inflow from the fault cannot be estimated. The exploration adit would not intersect the

Copper Lake Fault to reduce the potential risk of encountering unexpected inflows from this fault (ASARCO, Incorporated 1992).

During construction, pilot holes would be used to identify and characterize water bearing structures such as faults and fractures ahead of the advancing face of the adit so preparations could be made to handle expected inflows. If pilot drilling indicated the potential for large inflows of water, grouting would be used to control the water while advancing the face. If extreme amounts of water could not be controlled by grouting, a packer would be installed to seal the hole. At the end of the exploration adit, ASARCO would drill holes in a fan-like pattern to obtain information on characteristics of the fault.

Ground water inflow to the exploration adit would increase as the adit is extended, and would reach a maximum of about 112 gpm. Cumulative inflow to the exploration adit as a function of adit length is provided in **Table 4-7**. A safety factor of 1.5 was applied to this estimate to generate a reasonable case inflow of 168 gpm. The actual inflow may be higher or lower depending on the hydrogeologic characteristics encountered. Water requirements for driving the adit would average 30 gpm during the drilling cycle, and some additional water may be needed for dust control in the adit. A small amount of potable water would also be needed for the lavatory and lunchroom in the shop. Therefore, approximately 138 gpm of excess water would be produced during development of the exploration adit.

Underground Mine. Ground water inflow into mine adits would be about 152 gpm. Cumulative inflow to the adits as a function of adit length is provided in **Table 4-8**. A safety factor of 1.5 was applied to this estimate to generate a reasonable case inflow of 228 gpm. Actual inflows may be higher or lower depending on local hydrogeologic conditions.

Ground water in the mine area occurs primarily in fractures (joints and faults) in bedrock. Assuming the mine workings were below the water table, ground water would eventually flow into the underground workings. Mine inflows would occur when a saturated fracture or saturated fracture system was encountered by the mine adit or workings. If not grouted, inflow from the fracture would soon decline as ground water stored in the fracture flowed in to the mine workings. Inflow would still continue from the fracture, but at a lesser rate. This rate would be equal to the rate of ground water recharge to the fracture or the same rate as steady state conditions. Inflow into the mine workings would increase as the size of the mine increased, and would reach a maximum of about 1,650 gpm (safety factor equal to 2.0) by the end of production. A larger safety factor was used to reflect a greater degree of uncertainty in the estimated inflow. Cumulative inflow to the mine as a function of time is provided in **Table 4-9**. ASARCO would grout areas where water was flowing into the adits and mine workings. Grouting would be used as the primary mechanism to reduce adit and mine inflows. A summary of combined inflows to the exploration adit, conveyor and service adits, and underground mine, including safety factors to account for uncertainty in the estimates, are provided in **Table 4-10**. Actual inflows may be higher or lower depending on local hydrogeologic conditions. Variations in flow estimates ultimately would affect the size of treatment systems and the area required for siting treatment facilities, and the rate of ground water withdrawals for make-up water supplies.

TABLE 4-7.
Ground Water Inflow to the Exploration Adit

Adit Segment (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Hydraulic Conductivity[1] (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow to Adit (gpm)
0 - 500	200	0	1.13×10^{-5}	0	0	0
500 - 1,000	400	0	1.13×10^{-5}	0	0	0
1,000 - 1,500	575	75	1.13×10^{-5}	0.0155	7.7	7.7
1,500 - 2,000	775	275	1.13×10^{-5}	0.0376	18.8	26.6
2,000 - 2,500	750	250	1.13×10^{-5}	0.0351	17.5	44.1
2,500 - 3,000	625	125	1.13×10^{-5}	0.0215	10.7	54.8
3,000 - 3,500	525	25	1.13×10^{-5}	0.0090	4.5	59.3
3,500 - 4,000	475	0	1.13×10^{-5}	0	0	59.3
4,000 - 4,500	675	175	1.13×10^{-5}	0.0271	13.6	72.9
4,500 - 5,000	875	375	1.13×10^{-5}	0.0475	23.8	96.7
5,000 - 5,500	1,025	525	1.13×10^{-6}	0.0062	3.1	99.7
5,500 - 6,000	1,200	700	1.13×10^{-6}	0.0077	3.9	103.6
6,000 - 6,700	1,750	1,250	1.13×10^{-6}	0.0123	8.6	112.2

Source: ASARCO, Incorporated 1987-1994.
Note: [1]Based on field data.

TABLE 4-8.
Ground Water Inflow to the Conveyor/Service Adits for Alternative II

Adit Segment/ (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Hydraulic Conductivity[1] (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow (gpm)
0 - 1,000	463	0	0	0	0	0
1,000 - 2,000	756	256	1.13×10^{-5}	0.0403	40.3	40.3
2,000 - 3,000	463	369	1.13×10^{-6}	0.0524	52.4	92.7
3,000 - 4,000	1,022	522	1.13×10^{-6}	0.0068	6.8	99.5
4,000 - 5,000	1,295	795	1.13×10^{-6}	0.0094	9.4	108.9
5,000 - 6,000	1,428	928	1.13×10^{-6}	0.0106	10.6	119.5
6,000 - 7,000	1,301	801	1.13×10^{-6}	0.0094	9.4	128.9
7,000 - 8,000	1,534	1,034	1.13×10^{-6}	0.0115	11.5	140.4
8,000 - 9,000	1,507	1,007	1.13×10^{-6}	0.0113	11.3	151.7

Source: ASARCO, Incorporated 1987-1994.
Note: [1]Based on field data.

TABLE 4-9.
Ground Water Inflow to the Underground Mine for Alternative II

Production Year	Tons Mined	Percent of Ore Body	Area (ft^2)	Inflow to New Area (gpm)	Cumulative Inflow (gpm)
1	996,000	1.12	340,416	9.2	9.2
2	3,197,200	3.60	1,092,751	29.4	38.6
3	3,535,300	3.98	1,208,308	32.5	71.1
4	3,566,300	4.02	1,218,903	32.8	103.9
5	3,555,200	3.98	1,215,109	32.7	136.6
6	3,566,300	4.01	1,216,750	32.8	169.4
7	3,560,000	4.01	1,216,750	32.8	202.2
8	3,560,000	4.01	1,216,750	32.8	235.0
13	17,800,000	20.04	6,083,750	163.8	398.8
18	17,800,000	20.04	6,083,750	163.8	562.6
23	17,800,000	20.04	6,083,750	163.8	726.4
26	10,680,000	12.02	3,650,250	98.3	824.7

Source: ASARCO, Incorporated 1987-1994.

TABLE 4-10.
Estimated Ground Water Inflows for Alternative II

Proposed Project Portal Site	Inflow in gpm (no safety factor)	Inflow in gpm (safety factor applied)
Evaluation Adit	112	168
Conveyor and Service Adits	152	228
Ore Body Area	825	1,650
Total Inflow	1,089	2,046

Source: ASARCO, Incorporated 1987-1994.
Note: Safety factors of 1.5 (for the adits) and 2.0 (for the ore body) were used. Flow rates and safety factors are estimated and may differ based on local and site-specific conditions.

Excess Mine Water Storage. By year 30, up to a maximum of 207.7 million gallons of mine water could be stored in a reservoir in the underground mine as a method of managing excess water (see **Figure 2-17**). The maximum volume stored each year would vary. For example, during year 6, only 75.7 million gallons would be stored. Storage would have a seasonal component, with the largest volume being stored during late spring and early summer (ASARCO, Incorporated 1995). The reservoir would be developed in mined out sections of the ore body. Assuming that underground fractures or fracture systems intercepted the reservoir, the potential for seepage from the reservoir to ground water exists. The rate of seepage cannot be determined, and would depend on the bedrock hydraulic conductivity and the degree and connection between fracturing. Seepage water would likely contain elevated concentrations of nitrate, metals, and total dissolved solids (TDS). Seepage could either be retained in fractures or could migrate and possibly exit to the surface at undetermined locations in the form of springs or seeps.

Tailings Impoundment Seepage. Tailings slurry decant water would probably seep from the base of the tailings impoundment and enter the ground water system during the mine's operational life. The rate of seepage would be proportional to the impoundment area and the depth of water in the impoundment. The seepage rate would increase as the size of the impoundment increased (ASARCO, Incorporated 1987-1994).

The maximum rate of seepage from the proposed tailings impoundment may be several hundred gpm (ASARCO, Incorporated 1987-1994). The Agencies have used a value of 241 gpm in the ground water loading analysis. The actual value could be higher or lower depending on actual site geologic conditions and water transmitting properties of tailings materials and aquifers.

After the tailings impoundment was reclaimed, seepage from the impoundment would decrease dramatically because tailings water would no longer be stored, and surface water runoff from precipitation would be rerouted off the reclaimed impoundment surface to minimize infiltration. At the end of operations, saturated water levels in the tailings impoundment would decrease until steady-state conditions were achieved. Seepage through the tailings dam and the bottom of the impoundment also would decrease as the saturated water levels dropped. Lower portions of the tailings mass would remain saturated after new steady-state conditions were established. Under these conditions, total seepage (seepage through the dam and the bottom of the impoundment) would decrease significantly.

The length of time necessary to completely dewater the tailings impoundment cannot be predicted with accuracy. Dewatering could occur in the impoundment over several decades, and would be limited due to the low permeability of the underlying lacustrine sediments. Therefore, the perimeter seepage collection system would potentially need to be operated and maintained for several decades.

Mine Closure. ASARCO would monitor inflow to underground workings during operations in order to predict whether the adits would discharge mine water following operations, and whether the expected flow would meet applicable water quality standards. If the discharge did not meet permit requirements, ASARCO proposes to seal the adits following the cessation of operations. Adit sealing is a technique used to control and redirect mine water flow; it does not prevent mine water discharge. Water quality of mine discharge is discussed under Surface Water Quality.

If the adits were successfully sealed, the mine water would rise until the outflow along natural pathways equaled the rate of mine water inflow. Ground water elevations may return to their premining levels. Instead of one or two point-source discharges at the mine adits, mine water discharge would be more diffuse, occurring as springs and seeps, discharge to valley fill ground water systems, and/or baseflow in streams. If the adit plugs leaked, the rise in mine water levels would be less. However, adit sealing would likely have little effect on the discharge water quality. Adit plugs have an expected life ranging from several decades to centuries. Without periodic inspection and maintenance, the adit plugs may eventually fail. In this event, water under pressure would discharge to the surface, would cause erosion, and would increase flow in Rock Creek and its tributaries.

Ground Water Quality

Tailings impoundment seepage would be diluted by ground water flow beneath the impoundment, and would be contained in a DHES-approved ground water mixing zone using a system of perimeter trenches and recovery wells. Seepage impacts to ground water outside the mixing zone would be minor. The seepage collection and pump back system are discussed under the section heading Seepage Collection and Pump Back System.

Seepage Water Quality. The Agencies expect that the quality of the tailings slurry decant water for the proposed project would be similar to the ASARCO Troy tailings water. ASARCO Troy tailings water characteristics are presented in **Table 4-11** (ASARCO data) and **Table 4-12** (DHES data). Leachate from the proposed Rock Creek tailings impoundment would probably percolate into ground water and change the quality of ground water below the tailings impoundment. Seepage would recycle back to the tailings impoundment via a perimeter seepage collection system. The Agencies are confident that a perimeter seepage collection system can be properly engineered to prevent degradation to ground water outside an established mixing zone, to Rock Creek, or to the Clark Fork River. After mining, the seepage from the impoundment would decrease and the resulting water quality would improve. Analysis of water quality is provided in **Table 4-13.** After mining, concentrations would decrease from these values and approach baseline. The time required for this is unknown.

After mine closure, the tailings impoundment would slowly dewater, thus lowering water levels and exposing any sulfide mineralization in the tailings to oxidation and bacterial action. This could potentially result in acid formation and the release of dissolved metals to ground water. Initial testing of the tailings material, however, indicates a net neutralizing potential (see **Table 4-14**). The tailings also would have a low sulfide content (Timothy Hayes, U.S. Geological Survey, in a letter to Rebecca Miller, March 6, 1995). Although uncertainty exists, acid drainage from the tailings is not expected. Following operations, ASARCO would monitor water quality in the vicinity of the tailings impoundment.

Seepage Collection and Pump Back System. Seepage to ground water from the impoundment would be intercepted by a tailings impoundment seepage collection system consisting of underdrains, seepage collection trenches, and ground water capture wells. The collection system would penetrate to bedrock in areas where bedrock was within approximately 20 feet of the surface. Where possible, the collection trenches would form a cutoff barrier for ground water migration that extended to bedrock. Ground water capture wells would be located approximately 200 to 300 feet downgradient of the seepage

TABLE 4-11.
(ASARCO Data) Troy Tailings Impoundment Water Quality

Parameter	Number of Samples	Data Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	46	7.5	0.3	8.4	6.8
Total Suspended Solids	51	663	1,257	6,541	<1
Total Hardness (as $CaCO_3$)	47	18	15	103	21
Calcium	56	18	6	30	5.6
Magnesium	50	5.8	3.4	20	1.6
Sodium	48	18	9	15	1.7
Potassium	51	30	17	75	0.8
Bicarbonate	46	30	30	150	21
Sulfate (SO_4)	52	22	9	42	1.6
Chloride	48	6.0	3.1	15	<1
Ammonia (NH_3 as N)	51	8.8	12.5	30	0.05
Total Kjeldahl Nitrogen (as N)	49	7.5	3.4	20	0.03
Nitrate and Nitrite (as N)	54	15.6	7.0	30	2.3
Orthophosphate (PO_4-P)	47	0.03	0.04	0.23	<.01
Total Phosphorous	47	0.06	0.06	3.3	<0.01
Arsenic (DIS)	0	ND	ND	ND	ND
Arsenic (TRC	0	ND	ND	ND	ND
Cadmium (DIS)	0	ND	ND	ND	ND
Cadmium (TRC)	49	0.002	0.001	0.005	<.0001
Chromium (DIS)	0	ND	ND	ND	ND
Chromium (TRC)	0	ND	ND	ND	ND
Copper (DIS)	0	ND	ND	ND	ND
Copper (TRC)	56	0.44	0.67	3.3	0.007
Iron (DIS)	0	ND	ND	ND	ND
Iron (TRC)	53	2.4	5.6	38	0.04
Lead (DIS)	0	ND	ND	ND	ND
Lead (TRC)	57	0.115	0.307	2.2	<.001
Manganese (DIS)	0	ND	ND	ND	ND
Manganese (TRC)	52	1.9	8.3	63	0.02
Mercury (DIS)	0	ND	ND	ND	ND
Mercury (TRC)	0	ND	ND	ND	ND
Selenium (DIS)	0	ND	ND	ND	ND
Selenium (TRC)	0	ND	ND	ND	ND
Silver (DIS)	0	ND	ND	ND	ND
Silver (TRC)	51	0.004	0.005	0.023	<.0002
Zinc (DIS)	0	ND	ND	ND	ND
Zinc (TRC)	55	0.085	0.377	2.8	0.001

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise indicated.

SU =Standard pH Units
TRC =Total Recoverable Metals Analysis
DIS =Dissolved Metals Analysis
ND =No Data

TABLE 4-12.
(DHES Data) Troy Tailings Impoundment Water Quality

Parameter	Number Of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	1	7.7	ND	7.7	7.7
Total Suspended Solids	0	ND	ND	ND	ND
Total Hardness (as $CaCO_3$)	1	79	ND	79	79
Total Alkalinity (as $CaCO_3$)	1	111	ND	111	111
Sulfate (SO_4)	1	44.9	ND	44.9	44.9
Ammonia (NH_3 as N)	1	13.8	ND	13.8	13.8
Total Kjeldahl Nitrogen (as N)	0	ND	ND	ND	ND
Nitrate and Nitrite (as N)	1	29.8	ND	29.8	29.8
Orthophosphate (PO_4-P)	1	0.015	ND	0.015	0.015
Total Phosphorus	0	ND	ND	ND	ND
Arsenic (DIS)	2	0.004	ND	0.007	<0.001
Arsenic (TRC)	1	0.014	ND	0.014	0.014
Cadmium (DIS)	1	<0.001	ND	<0.001	<0.001
Cadmium (TRC)	1	<0.001	ND	<0.001	<0.001
Chromium (DIS)	1	<0.001	ND	<0.001	<0.001
Chromium (TRC)	1	0.002	ND	0.002	0.002
Copper (DIS)	2	0.026	ND	0.036	0.016
Copper (TRC)	1	1.16	ND	1.16	1.16
Iron (DIS)	2	0.03	ND	0.05	<0.01
Iron (TRC)	1	1.17	ND	1.17	1.17
Lead (DIS)	2	0.0015	ND	0.002	<0.001
Lead (TRC)	1	0.028	ND	0.028	0.028
Manganese (DIS)	2	0.747	ND	1.03	0.464
Manganese (TRC)	1	1.16	ND	1.16	1.16
Mercury (DIS)	0	ND	ND	ND	ND
Mercury (TRC)	0	ND	ND	ND	ND
Selenium (DIS)	0	ND	ND	ND	ND
Selenium (TRC)	0	ND	ND	ND	ND
Silver (DIS)	1	<0.001	ND	<0.001	<0.001
Silver (TRC)	1	<0.001	ND	<0.001	<0.001
Zinc (DIS)	2	0.0395	ND	0.068	0.011
Zinc (TRC)	1	0.023	ND	0.023	0.023

Source: Department of Health and Environmental Sciences 1995.

Notes: All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
TRC = Total Recoverable Metals Analysis
DIS = Dissolved Metals Analysis
ND = No Data

TABLE 4-13.
Estimated Ground Water Quality Resulting from Tailings Impoundment Seepage Below Tailings Impoundment

Parameter	Ambient Groundwater Quality§	Estimated Tailings Seepage Water Quality	Resultant Groundwater Quality	Montana Water Quality Standard
pH (SU)	7.97	7.5[a]	7.79	N/A
Total Hardness (as $CaCO_3$)	194	68[a]	112	N/A
Total Alkalinity (as $CaCO_3$)	394	111[b]	211	N/A
Sulfate (SO_4)	4.1	22[a]	15.7	N/A
Ammonia (NH_3 as N)	<0.01*	8.8[a]	5.7	N/A
Total Kjeldahl Nitrogen (as N)	<0.01*	8.1[a]	5.2	N/A
Nitrate and Nitrite (as N)	0.4589	15.6[a]	10.3	10
TIN	0.46	24.4[a]	16.0	N/A
Orthophosphate (PO_4-P)	<0.01	0.03[a]	0.02	N/A
Total Phosphorus	3.2397	0.06[a]	1.18	N/A
Arsenic (DIS)	0.0023	0.004[b]	0.0034	0.018
Cadmium (DIS)	0.0013	<0.001[b]	0.0011	0.005
Chromium (DIS)	<0.01	<0.001[b]	<0.01	0.1
Copper (DIS)	<0.001	0.026[b]	0.017	1.0
Iron (DIS)	0.0527	0.03[b]	0.038	0.3
Lead (DIS)	<0.001	0.0015[b]	0.0011	0.015
Manganese (DIS)	0.2424	0.747[b]	0.57	0.05
Mercury (DIS)	<0.0002	ND	ND	0.00014
Selenium (DIS)	<0.004	ND	ND	0.05
Silver (DIS)	<0.0002	<0.001[b]	<0.0002	0.0005
Zinc (DIS)	0.0459	0.0395[b]	0.042	5.0

Source: (a) = ASARCO, Incorporated 1987-1994 (see Table 4-11). (b) = Department of Health and Environmental Sciences 1995, (see Table 4-12)

Notes: All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
¶ = pH and Temperature Dependent
ND = No Data
N/A = Not Applicable

Shading = Exceeds Standard
§ = See Table 3-11
* = Uses minimum value from Table 3-11
DIS = Dissolved

TABLE 4-14.
Acid-Base Accounting

Acid-Base Accounting For Tailing Solids And Waste Rock			
Description	Acid Neutralization Potential	Acid Generating Potential	Net Neutralization Potential
Troy Tailings	7.8	2.5	+5.3
Rock Creek Tailings	11	<1	+10
Rock Creek Waste Rock	84	<1	+83

Source: ASARCO, Incorporated 1987-1994.

collection ditches to minimize the potential for capture wells to induce or accelerate seepage from the impoundment and seepage collection ditches. Capture wells would intercept ground water coming from each of the impoundment sub-basins and would return it to the impoundment (see **Figure 2-13**). This also would potentially decrease static water levels in wells outside of Clark Fork alluvium and springs downgradient of Miller Gulch during mine operation.

Wells would be operated through the mine's operational life and until such time as seepage-contaminated ground water met water quality standards. ASARCO's conceptual plan for the collection system consists of 11 capture wells. The perimeter recovery system could be designed to prevent migration of contaminated ground water from leaving an Agency-approved ground water mixing zone. Estimated ground water quality within the mixing zone is shown on **Table 4-13.** Nitrate and nitrite, and manganese would exceed static ground water quality standards during mine operation but would return to pre-mine levels when the impoundment reached equilibrium. (Manganese already exceeds standards in ambient ground water.) The seepage collection system could be designed to eliminate the potential for migration of constituents to Rock Creek and the Clark Fork River. Ground water pumping systems are a proven technology for containment of chemicals in ground water (U.S. Environmental Protection Agency 1985; U.S. Environmental Protection Agency 1988; Mercer et al. 1990). For example, systems have been designed to treat several thousand gpm, however it is expected that at this site, less than several hundred gpm would be treated. In less than ideal settings, the effectiveness of the technology may decrease. Therefore, continued monitoring of the pumping systems for potential bypass by seepage-contaminated ground water is essential. If monitoring indicated bypass of seepage, the pumping rates could be adjusted, or additional wells could be added to increase the efficiency of the pump-back system.

Geotechnical drilling to support the final design plans for the perimeter seepage collection system would determine final design and spacing of the impoundment capture wells. These wells would be designed to capture ground water from the basal gravel, shallow bedrock, and lacustrine aquifers. Beneficial uses of ground water within the mixing zone would be precluded.

Surface Water Quantity

Exploration Adit. The proposed exploration adit area lies adjacent to an unnamed tributary within the headwaters of the West Fork of Rock Creek drainage. The location is about 2,000 feet south and 500 feet vertically below the drainage divide that separates the West Fork of Rock Creek and Copper Gulch. The unnamed tributary is ephemeral near the proposed adit location and becomes perennial about 0.8 miles below the proposed adit location where two springs provide perennial flows between 20 and 100 gpm. The ephemeral section of the stream above the springs only flows for a brief period during the spring snowmelt period. In addition, one horizontal exploration 1,420-foot drillhole along the proposed adit alignment produced less than 5 gpm of water. It is not anticipated that the exploration adit would affect existing spring flow, or tributary flow to Rock Creek.

Wilderness Lakes. There are two lakes located above or adjacent to the underground mine area, including Cliff, Copper, and Rock lakes. Major faults such as the Copper Lake Fault, and fracturing resulting from mining might act as conduits for vertical ground water flow. The potential for impacting wilderness lakes is extremely remote (see Geology). Nonetheless, faults and fractures might provide a hydraulic connection between mine workings and overlying surface or ground water if ASARCO's pilot hole testing and grouting programs were ineffective. As a result, water levels in lakes and surface outflow from the lakes might be reduced. The potential for subsidence would be greater if pillars were robbed toward the end of mining (see Geology).

To minimize the potential for impacts to surface water resources in the wilderness, ASARCO would maintain an adequate pillar size and spacing that would be based on rock mechanics data collected during construction of the exploration adit. ASARCO would also maintain a barrier pillar near the Copper Lake Fault to isolate the mine workings from water stored in the fault and to avoid the possibility of lowering lake water levels.

ASARCO's proposed monitoring program would detect and evaluate changes in lake water levels, and would allow the Agencies and ASARCO to take requisite actions. The avoidance distances, monitoring plan, and hydrologic studies should be sufficient to prevent and detect effects to nearby lakes and to prevent significant inflows from faults.

Mill Facility and Makeup Water Requirements. The proposed mill facility would require up to 3,131 gpm of water during the project's operational phase. Mill makeup water would first come from excess water in the mine or from the tailings impoundment, if available. During the first few years of mining, sufficient makeup water may not be available from these sources. During this time, a well located at the confluence of Rock Creek and the Clark Fork River would supply the required makeup water. Maximum pumping rates would be expected to occur during project start-up or during extremely dry periods. Water balance estimates suggest the proposed mill would likely require makeup water from a supply well during the months of July, August, and September (ASARCO, Incorporated 1987-1994).

Actual makeup water requirements from a production well would depend on the uncertain availability of mine water. Therefore, the timing and rate of discharge cannot be quantified. The flow in the Clark Fork River could be reduced by an amount equal to the discharge rate of ASARCO's production well. The greatest impact to the Clark Fork River would occur during periods of low streamflow during the first few years of mining. Assuming low flow in the Clark Fork River is 3,100 CFS (the 7-day 10-year low flow [$Q_{7,10}$]), a withdrawal of 3,131 gpm would potentially decrease flows in the Clark Fork River by an equal amount, or only by 0.2 percent. Assuming the average flow is 21,460 cfs, a withdrawal of 3,131 gpm would potentially decrease the flow in the Clark Fork River by only 0.03 percent. Downstream mainstem senior appropriators on the Clark Fork River would not be affected due to flow available in the Clark Fork River and storage capacity of Cabinet Gorge Reservoir. The ability to generate hydroelectric power at Cabinet Gorge could be reduced. The monetary impact of this loss is insignificant, and would likely be offset by the purchase of electrical power for the proposed project.

Drainage and Surface Water. Construction of the proposed tailings impoundment would alter the topography of about 324 acres in Miller Gulch. During the proposed project life, about 5 miles of ephemeral tributaries to Miller Gulch would be covered by fill material and tailings, and would essentially be removed from the natural hydrologic system. Therefore, surface water runoff to Miller Gulch would be expected to decrease temporarily during the proposed mine life. In addition, one spring and several existing ground water monitoring wells would be covered by tailings material. ASARCO's reclamation plan calls for grading the impoundment surface from the embankment crest to the head of the impoundment. Runoff from the reclaimed impoundment surface would be routed to a diversion ditch and transferred to the Rock Creek drainage and Miller Gulch. Flows into West Fork of Rock Creek near the proposed mill site would be rerouted in culverts, and likely would impact existing Waters of the U.S. (see Waters of the U.S. and Wetlands).

Surface flow from Miller Gulch is currently appropriated for power generation, irrigation, and domestic uses (Water rights P029428, W131977, and W131978). ASARCO does not have water rights to appropriate surface water in Miller Gulch. The disruption of natural surface water runoff to Miller Gulch during the proposed mine life could, at times, reduce flows for existing beneficial uses of surface water. These impacts, however, cannot be quantified. In addition, under the Metal Mine Reclamation Act (82-4-355 MCA), ASARCO would be required to repair or replace any existing use of surface or ground water that is affected by the proposed project.

Surface Water Quality

Adit and Mine Water. Drilling and blasting activities would contribute to high concentrations of suspended solids in the adit water and mine effluent. Suspended solids contribute nearly all of the total metals load to mine effluent and must be removed. Initial removal of suspended solids can be accomplished using settling sumps, with or without chemical flocculating agents and subsequent filtration. Although this treatment scheme would significantly improve water quality, some dissolved metals and most of the nitrogen compounds would remain in the water.

Underground mining is expected to influence mine discharge water quality mainly as a result of blasting activities. As much as 1 to 6 percent of the nitrogen in the explosives would be expected to remain in water discharged from the mine (British Columbia Ministry of the Environment 1983). Blasting would employ ammonium nitrate based explosives that would leave residues of soluble nitrogen compounds to dissolve in mine inflow water. Wet blasting conditions in the mine and the use of slurry explosives appear to increase residual nitrogen. In general, the nitrogen discharged from the mine would be mainly nitrate, with relatively small amounts of more toxic ammonia and nitrite (British Columbia Ministry of the Environment 1983). Best management practices would be employed during blasting operations when using explosives to limit use and minimize spillage of blasting agents.

During the latter stages of mining, the mine may at times discharge about 1,700 gpm of water as a result of seepage from ground water into the mine workings. Discharge from the mine would be expected during the operational and postoperational periods of mining. Due to similarities in the geology of the ore bodies, mining methods, and type of explosives, it is assumed that mine adit water quality for the proposed project would be similar to mine adit water quality for the ASARCO Troy Mine.

ASARCO Troy adit water quality during the operational period is provided in **Table 4-15**. The analysis of data indicates untreated mine water would contain elevated levels of TSS, nitrate, and total metals. The concentration of dissolved metals is generally lower than total metals concentrations. This suggests that most of the metals content in the mine water would be in the suspended solids.

TABLE 4-15.
Operational Adit Water Quality for Troy Mine

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	4	7.3	ND	7.4	7.1
Total Dissolved Solids	4	189	25	215	163
Total Suspended Solids	4	2,573	628	3,240	1,840
Total Hardness	4	83	8	89	73
Sulfate (SO4)	4	23.3	14.9	32.0	1.0
Ammonia (NH_3 as N)	4	8.2	2.6	10.2	4.4
Kjeldahl N	1	7.3	2.1	9.1	4.2
Nitrate	4	17.0	6.5	22.4	7.5
Nitrite	4	0.32	0.15	0.44	0.10
Ortho-Phosphate	4	<0.01	0	<0.01	<0.01
Phosphorous	1	0.02	0.01	0.03	0.01
Aluminum (DIS)	4	<0.1	0	<0.1	<0.1
Aluminum (TRC)	4	6.9	0	6.9	6.9
Arsenic (DIS)	4	<0.005	0	<0.005	<0.005
Arsenic (TRC)	4	0.027	0	0.027	0.027
Barium (DIS)	4	<0.1	0	<0.1	<0.1
Barium (TRC)	1	10.0	0	10.0	10.0
Cadmium (DIS)	4	<0.001	0	<0.001	<0.001
Cadmium (TRC)	1	0.002	0	0.002	0.002
Copper (DIS)	4	0.075	0.010	0.090	0.07
Copper (TRC)	1	30.9	0	30.9	30.9
Lead (DIS)	4	<0.01	0	<0.01	<0.01
Lead (TRC)	1	2.4	0	2.4	2.4
Manganese (DIS)	4	0.42	0.09	0.55	0.33
Manganese (TRC)	1	2.79	0	2.79	2.79
Mercury (DIS)	4	<0.001	0	<0.001	<0.001
Mercury (TRC)	1	<0.001	0	<0.001	<0.001
Silver (DIS)	4	<0.005	0	<0.005	<0.005
Silver (TRC)	1	0.011	0	0.011	0.011
Zinc (DIS)	4	0.018	0.005	0.020	0.010
Zinc (TRC)	1	0.13	0	0.13	0.13

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise noted.
SU =Standard pH Units
DIS =Dissolved Metals Analysis
TRC =Total Recoverable Metals Analysis
ND =No Data

Based on September 1994 data collected by DSL, postoperational mine water quality is expected to be similar or better than what is shown in **Table 4-16**. The potential for acid mine drainage exists, but is not anticipated based on available static testing data. The Troy Mine may be the best predictive model available for the proposed project. No acid mine drainage has been noted at this field site during its 13-year construction and operation. Postoperational mine water quality data for the ASARCO Troy Mine suggest that concentrations of constituents decrease with time. For example, September 1994 data from DSL indicated all previously elevated metals concentrations have decreased (Copper [TR]-0.088 mg/L; Lead [TR]-0.004 mg/L; Manganese [TR]-0.165 mg/L; Silver [TR]-<0.001 mg/L; Zinc [TR]-0.007 mg/L. Because recent data indicate some metals exceeded standards in September 1994, continued adit water treatment is expected until such time that standards can be met without treatment. The decrease is likely the result of the termination of mining, sediment production, and use of explosives.

Acid Drainage. Acid drainage is the result of complex chemical and biological reactions. Acid production depends on the amount and type of sulfides, the amount of neutralizing material available in the rock, site conditions and other factors. The development of acid drainage is time-dependent and, at some sites, may evolve over a period of many years (British Columbia Acid Mine Drainage Task Force, 1989). Drainage from acid-producing rocks typically contains elevated heavy metals that can adversely affect water quality and aquatic life. Potential sources of acid drainage for the proposed project are waste rock that would be stored on the surface and used in tailings embankment construction, ore temporarily stockpiled on the surface and exposed within the mine, and tailings deposited in the impoundment. All these rocks contain some sulfide minerals.

Waste rock excavated to develop the exploration adit would be quartzites and siltites of the Revett Formation that have low potential for leachable metals and sulfides. Characteristics of waste rock material at ASARCO's Troy and Rock Creek projects are provided in **Table 4-17**. Results of acid-base generating potential are provided in **Table 4-14**. These analyses suggest that exposure of Rock Creek ore and waste rock by mining would not generate acidic mine water. The ability of near neutral pH adit water to leach metals would also be low. Additional Acid Base Accounting (ABA) would be performed during the construction of the exploration adit to ensure the adit and excavated material were not acid generating.

The uncertainty in predicting acid generation potential is considered greatest when the acid-base value is between -20 and +20 (British Columbia Acid Mine Drainage Task Force, 1989). The average acid potential/neutralization potential (AP/NP) of Rock Creek waste rock samples is +84. Therefore, waste rock is not expected to be acid producing. The AP/NP for tailings ranges between +5.3 (Troy tailings) and +11 (Rock Creek Tailings). Based on the static test results of the tailings, it is uncertain whether acid drainage would occur. However, because acid drainage at the ASARCO Troy Mine has not occurred, and because the ore deposit and overburden is similar (T. Hayes, pers. comm., March 6, 1995), it would not be expected for the proposed project.

Kinetic laboratory and field tests have not yet been conducted at the proposed project site. Such tests may be useful in predicting acid drainage potential, but uncertainty would still remain. Kinetic texts attempt to predict the rate of acid generation over time, usually over a period of months. Mathematical models are used to extrapolate the results over periods of many years, decades, or even centuries (British

TABLE 4-16.
ASARCO Data: Postoperational Adit Water Quality for ASARCO Troy Mine

Parameter	Number of Samples	Average	Standard Deviation	Maximum Value	Minimum Value
pH (SU)	10	7.3	0.3	7.9	6.9
Total Suspended Solids	10	2.4	2.4	7.2	< 1.0
Total Hardness (as $CaCO_3$)	10	98	26	133	61
Total Alkalinity (as $CaCO_3$)	0	ND	ND	ND	ND
Sulfate (SO_4)	10	28	7	38	18
Ammonia (NH_3 as N)	10	0.64	0.51	1.8	0.11
Total Kjeldahl Nitrogen (as N)	0	ND	ND	ND	ND
Nitrate and Nitrite (as N)	10	3.84	2.62	8.38	0.56
Orthophosphate (PO_4-P)	0	ND	ND	ND	ND
Total Phosphorus	0	ND	ND	ND	ND
Arsenic (DIS)	0	ND	ND	ND	ND
Arsenic (TOT)	0	ND	ND	ND	ND
Cadmium (DIS)	0	ND	ND	ND	ND
Cadmium (TOT)	0	ND	ND	ND	ND
Chromium (DIS)	0	ND	ND	ND	ND
Chromium (TOT)	0	ND	ND	ND	ND
Copper (DIS)	0	ND	ND	ND	ND
Copper (TOT)	10	0.21	0.09	0.38	0.11
Iron (DIS)	0	ND	ND	ND	ND
Iron (TOT)	10	0.153	0.086	0.320	0.041
Lead (DIS)	0	ND	ND	ND	ND
Lead (TOT)	10	0.011	0.006	0.023	0.005
Manganese (DIS)	0	ND	ND	ND	ND
Manganese (TOT)	10	0.27	0.13	0.47	0.12
Mercury (DIS)	0	ND	ND	ND	ND
Mercury (TOT)	0	ND	ND	ND	ND
Selenium (DIS)	0	ND	ND	ND	ND
Selenium (TOT)	0	ND	ND	ND	ND
Silver (DIS)	0	ND	ND	ND	ND
Silver (TOT)	10	<0.001	0.001	0.004	<0.001
Zinc (DIS)	0	ND	ND	ND	ND
Zinc (TOT)	10	0.026	0.025	0.100	0.010

Source: ASARCO, Incorporated 1987-1994.

Notes: All units are in mg/L unless otherwise noted. Period of record is from October 1992 to June 1994. One sample collected by DSL on 9/20/94 corroborates these data. Concentrations appear to decrease with time.

SU = Standard pH Units
TOT = Total Metals Analysis
DIS = Dissolved Metals Analysis
ND = No Data

TABLE 4-17.
Characteristics of Tailings Solid and Waste Rock

Parameter	Whole Rock Analysis For Tailing Solids and Waste Rock		E.P. Toxicity[2] Analysis For Tailing Solids and Waste Rock	
	Troy Tailings	Rock Creek Waste Rock[1]	Troy Tailings	Rock Creek Waste Rock[1]
Aluminum	34,500	4*	0.18	<1
Antimony	<25	9	<0.1	<1
Arsenic	3.8	12	<0.004	<0.5
Barium	1,410	295	0.26	<10
Beryllium	<1.0	7	<0.004	<0.05
Cadmium	<10	9	<0.004	<0.1
Calcium	3,950	3*	58	375
Chromium	31	33	<0.3	<0.5
Cobalt	<5.0	<1	<0.03	<0.1
Copper	630	9	0.15	15
Iron	7,600	1.21*	2.3	<1
Lead	120	13	0.04	<0.3
Magnesium	1,650	<1*	8.1	16.7
Manganese	540	1,324	9.4	<0.5
Mercury	ND	<1.0	<0.03	<0.02
Molybdenum	<10	<1	<0.04	<0.05
Nickel	<10	2	0.13	<0.3
Potassium	23,500	ND	2.4	ND
Selenium	<.50	<1	<0.004	<0.5
Silver	4.6	<1	<0.004	<0.1
Sodium	9,250	2*	1.3	ND
Zinc	10	52	0.04	12.4

Source: ASARCO, Incorporated 1987-1994.

Notes: [1] Waste Rock values are the average of three samples. In cases where values are less than detection limit, the detection limit value was used in calculation of the average.
All values parts per million except where noted by an asterisk (*). The asterisk indicates that the value is in percent.
[2] Extraction Procedure Toxicity Test Method (EPA Method 1310). This procedure has been used to characterize the leaching potential and degree of hazard associated with solid wastes.
ND = No Data.

Columbia Acid Mine Drainage Task Force 1989). These mathematical models are theoretical, however, and lack field data to verify whether the predicted results are valid.

The long-term potential for acid rock drainage from the Rock Creek project is unknown. Static tests would not predict this potential with any certainty. Kinetic tests would be useful, but mathematical extrapolations of the test data cannot be verified at this time by actual field data. Water monitoring conducted over the operating life and during post-operations should detect any acid drainage, if it occurs, or trends in water chemistry indicating the potential for long term acid drainage. Monitoring information would be evaluated and water treatment or other appropriate methods implemented.

Waste Rock. Waste rock would be produced as a result of driving the exploration adit and two access adits in nonmineralized rock in order to gain access to the ore body. Waste rock would be used in the construction of the mill pad, and would be stored on a hillside waste rock dump. Waste rock from the mineralized zone would be stored in underground workings.

Waste rock potentially containing residual nitrogen compounds from blasting and some fine grained material would be used in the construction of the proposed mill pad, and would potentially increase the load of nitrogen, TSS, and other non-toxic constituents in Rock Creek during the period of construction. Based on whole rock analysis (see **Table 4-17**), any sediment entering Rock Creek should not contain elevated concentrations of heavy metals. Resultant water quality impacts on Rock Creek cannot be estimated with certainty, and would depend on the explosive misfires or incomplete reactions, the relative use of slurry gels rather than ANFO, particle size distribution of the waste rock and the actual waste rock nitrogen content, rainfall and temperature conditions, infiltration capacity of the mill pad, potential for surface ponding, and actual streamflow during the period of construction. Research suggests that the impacts of leaching soluble nitrogen in waste rock would be short lived. Most nitrogen compounds could be leached out within 1 month to 1 year (British Columbia Ministry of the Environment 1983); the remainder would leach out within 5 years.

Milling Process. Reagents proposed by ASARCO range from non-toxic to toxic to humans and fish (see **Appendix F** and Aquatics/Fisheries).

Water Treatment. A passive biotreatment system would be used to treat mine water. Because passive biotreatment is viewed as an unproven technology, an ion exchange system also would be installed as a final polishing step to ensure the quality of water discharged to the Clark Fork River. ASARCO expects, and the Agencies concur that, by a combination of settling and sand filtration, passive biotreatment, and an ion exchange polishing step, Montana water quality regulations could be satisfied. As proposed, the system would remove up to 80 percent of the total dissolved solids, 80 percent of the heavy metals, 95 percent of the ammonia nitrogen, and 95 percent of the nitrate/nitrite nitrogen. **Table 4-18** provides ASARCO's estimate of untreated and treated water quality for the proposed project (ASARCO, Incorporated 1994). The maximum concentrations of the treated effluent are carried forward into **Tables 4-19 and 4-20** to estimate the reasonable worst case impacts to surface water quality. Average concentrations for treated effluent were also evaluated, but only for those constituents where the analysis using the maximum concentrations resulted in violations of water quality regulations.

TABLE 4-18.
Estimated Untreated and Treated Discharge Water Quality

Parameter	Effluent Prior to Treatment		Treated Effluent	
	Average Concentration[1]	Maximum Concentration	Average Concentration	Maximum Concentration
pH (SU)	7.5	8.4	7.5	8.4
Total Suspended Solids	663	6,541	10	30
Total Hardness (as $CaCO_3$)	68	300	18	300
Total Alkalinity (as $CaCO_3$)	ND	ND	ND	ND
Sulfate SO_4	22	42	22	42
Ammonia (NH_3 as N)	8.8	96.0	1.8	19.2
Total Kjeldahl Nitrogen (as N)	8.4	20.0	1.6	8.4
Nitrate and Nitrite (as N)	15.6	30.0	3.1	6.0
TIN	24.4	124.0	1.8	19.2
Orthophosphate (PO_4-P)	0.03	0.23	0.04	0.23
Total Phosphorus	0.06	0.23	0.06	0.23
Arsenic (DIS)	<0.005	<0.005	<0.005	<0.005
Arsenic (TOT)	0.027	0.027	<0.005	<0.005
Cadmium (DIS)	<0.001	<0.001	<0.001	<0.001
Cadmium (TRC)	0.002	0.005	<0.001	<0.001
Chromium (DIS)	ND	ND	ND	ND
Chromium (TRC)	ND	ND	ND	ND
Copper (DIS)	0.075	0.23	0.075	0.01
Copper (TRC)	0.44	3.3	0.081	0.105
Iron (DIS)	ND	ND	ND	ND
Iron (TRC)	8.4	38.0	0.04	0.17
Lead (DIS)	<0.01	<0.01	<0.01	<0.01
Lead (TRC)	0.115	2.2	<0.01	0.01
Manganese (DIS)	0.42	0.55	0.42	0.55
Manganese (TRC)	1.90	63.0	0.442	0.81
Mercury (DIS)	<0.001	<0.001	<0.001	<0.001
Mercury (TOT)	<0.001	<0.001	<0.001	<0.001
Selenium (DIS)	ND	ND	ND	ND
Selenium (TRC)	ND	ND	ND	ND
Silver (DIS)	<0.005	<0.005	<0.005	<0.005
Silver (TRC)	0.004	0.023	<0.005	<0.005
Zinc (DIS)	0.018	0.020	0.018	0.020
Zinc (TRC)	0.085	2.80	0.019	0.033

Source: ASARCO, Incorporated 1987-1994.

Notes: [1] All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
DIS = Dissolved Metals Analysis
TOT = Total Metals Analysis
TRC = Total Recoverable Metals Analysis
ND = No Data
TIN = Total Inorganic Nitrogen

TABLE 4-19.
Estimated Water Quality in the Clark Fork River at Average Flow (21,462 cfs) Resulting From Proposed Discharge

Parameter	Ambient Clark Fork Water Quality^{1}	Water Quality of Proposed Discharge	Resultant River Water Quality	Montana Water Quality Standard & Trigger Value
pH (SU)	8.09^{b}	8.4^{a}	8.09	6.5-8.5
Total Suspended Solids	2.5^{b}	30^{a}	2.5	N
Total Hardness (as $CaCO_3$)	85.7^{b}	300^{a}	85.7	N
Total Alkalinity (as $CaCO_3$)	80.7^{b,c}	ND^{a}	ND	N
Sulfate (SO_4)	<2.0^{a}	42^{a}	<2.0	N
Ammonia (NH_3 as N)	0.0056^{b}	19.2^{a}	0.0090	1.3*; 0.01^{t,¶}
Total Kjeldahl Nitrogen (as N)	0.1419^{b}	4.0^{a}	0.143	N/A
Nitrate and Nitrite (as N)	0.0273^{b}	6.0^{a}	0.0284	10; 0.01^{t}
TIN	0.0329^{b}	25.2^{a}	0.0374	N/A
Orthophosphate (PO_4-P)	0.003^{b}	0.23^{a}	0.143	N/A
Total Phosphorus	0.011^{b}	0.23^{a}	0.01105	N/A; 0.001^{t}
Arsenic	<0.001	<0.005^{a}	<0.001	0.018
Cadmium	0.000642^{b}	<0.001^{a}	0.000642	0.001; 0.0001^{t}
Chromium	<0.01^{a}	ND^{a}	ND	0.011; 0.005^{t}
Copper	0.0003^{b}	0.105^{a}	0.000318	0.011; 0.0005^{t}
Iron	0.04^{a}	0.17^{a}	0.040	0.3
Lead	0.0002^{b}	0.01^{a}	0.000201	0.003; 0.0001^{t}
Manganese	<0.008^{a}	0.84^{a}	<0.008	0.05
Mercury	<0.0005^{a}	<0.001^{a}	<0.0005	0.000012
Selenium	<0.005^{a}	ND^{a}	ND	0.005; 0.0006^{t}
Silver	<0.0002^{a}	<0.005^{a}	<0.0002	0.003; 0.0002^{t}
Zinc	0.0031^{b}	0.033^{a}	0.003105	0.095; 0.005^{t}

Source: (a) = ASARCO, Incorporated 1987-1994. (b) = Department of Health and Environmental Sciences 1994.

Notes: [1]All units are in mg/L unless otherwise indicated.

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
¶ = pH and Temperature Dependent
ND = No Data
t = Trigger Value
N = Narrative Standard
N/A = Not Applicable
c = As Alkalinity Increases, the Toxicity of Some Metals Decreases
* = Tom Reid, DHES, personal communication, June 18, 1995.

TABLE 4-20.
Estimated Water Quality in the Clark Fork River at Low Flow (3,100 cfs) Resulting from Proposed Discharge

Parameter	Ambient Clark Fork Water Quality[1]	Water Quality of Proposed Discharge[a]	Resultant River Water Quality	Montana Water Quality Standard & Trigger Value
pH (SU)	8.09[b]	8.4	8.09	6.5-8.5
Total Suspended Solids	2.5[b]	30	2.53	N
Total Hardness (as $CaCO_3$)	85.7[b]	300	85.72	N
Total Alkalinity (as $CaCO_3$)[d]	80.7[b]	ND	ND	N
Sulfate (SO_4)	<2.0[a]	42	<2.0	N
Ammonia (NH_3 as N)	0.0056[b]	19.2	0.029[c]	1.3*; 0.01[t,¶]
Total Kjeldahl Nitrogen (as N)	0.1419[b]	4.0	0.1466	N/A
Nitrate and Nitrite (as N)	0.0273[b]	6.0	0.035	0.01[t]
TIN	0.0329[b]	25.2	0.064	N
Orthophosphate (PO_4-P)	0.003[b]	0.23	0.0033	N/A
Total Phosphorus	0.011[b]	0.23	0.0113	0.001[t]
Arsenic	<0.001	<0.008	<0.001	0.018
Cadmium	0.000642[b]	<0.001	0.000642	0.001; 0.0001[t]
Chromium	<0.01[a]	ND	ND	0.011; 0.005[t]
Copper	0.0003[b]	0.105	0.00043	0.011; 0.0005[t]
Iron	0.09[b]	0.17	0.040	0.3
Lead	0.0002[b]	0.01	0.00021	0.003; 0.0001[t]
Manganese	<0.005[a]	0.84	<0.008	0.05
Mercury	<0.0005[a]	<0.001	<0.0005	0.000012
Selenium	<0.005[a]	ND	ND	0.005; 0.0006[t]
Silver	<0.0002[a]	<0.005	<0.0002	0.003; 0.0002[t]
Zinc	0.0031[b]	0.033	0.00314	0.095; 0.005[t]

Source: (a) = ASARCO, Incorporated 1987-1994. (b) = Department of Health and Environmental Sciences 1994

Notes: [1]All units are in milligrams per liter (mg/L) unless otherwise indicated.

SU = Standard pH Units
TIN = Total Inorganic Nitrogen
t = Trigger Value
¶ = pH and Temperature Dependent
ND = No Data
N = Narrative Standard
N/A = Not Applicable
▨ Shading = Exceeds Trigger Valve
c = Does Not Exceed Trigger Value Using Average Effluent Concentrations
d = As Alkalinity Increases the Toxicity of Some Metals Decreases
* Tom Reid, DHES, personal communication, June 15, 1995.

The actual effects on Clark Fork River water quality due to discharge of adit water from the proposed project would vary both seasonally and annually for the proposed 30-year mine operational period. The actual water quality impacts would be a function of the volume of water discharged from the mine, the flow rate in the Clark Fork River, and the concentration of chemical constituents in both (see **tables 19 and 20**). The degree of variation in the seasonal component of flow and water quality would be difficult to calculate for all possibilities using the available date base. Treated discharge would be piped to the Clark Fork River with a proposed outfall and underwater diffuser downstream of Noxon Reservoir. **Table 20** suggests the concentration of ammonia would possibly exceed the trigger level at low flow. Using average effluent concentrations, the trigger level for ammonia would not be exceeded.

Following operations, mine water would no longer be pumped from the underground workings, and the mine workings would fill with water until the rate of inflow equaled the rate of outflow. The length of time necessary for the mine to fill with water cannot be predicted with accuracy. Assuming inflows of 1,700 gpm and no outflows, the mine would take about 7 years to fill. Outflow would occur along natural pathways (fractures), or if water levels rose sufficiently, from the mine adits, if adits were not permanently sealed.

After the mine was reclaimed it could continue to be a ground water conduit, and would likely continue to discharge to surface water. ASARCO proposes to discharge all excess mine water to the Clark Fork River. The mine water quality would improve once mining activities were terminated. For example, the concentration of nitrates and other nitrogen compounds would return to near baseline conditions once the use of ammonium nitrate blasting was discontinued. In addition, the termination of mining activity would likely reduce the contribution of total suspended solids (TSS) and total metals to surface water to near baseline conditions.

Accidental Spills and Ruptures. Ruptures or breaks in either the proposed tailings slurry or return water lines could result in short-term water quality degradation of Rock Creek. Both pipelines would be encased in larger pipes at stream crossings, and emergency dump stations would be provided in critical reaches along the utility corridor. Slurry lines would be continuously operated and monitored at the concentrator. In the event that pipeline leakage occurred, the system would be shut down and immediately repaired. In addition, chemical spills at the concentrator would drain and be collected in a concrete sump located below grade.

The accidental rupture of a supply or tanker truck along the proposed utility corridor road could affect water resources in the Rock Creek drainage. The effect this event would have on the overall water quality of Rock Creek cannot be predicted, and would depend on 1) the response time for cleanup, 2) the toxicity of material(s) spilled, 3) the location of the spill relative to the creek, 4) the amount of material released into the environment, and 5) the quantity of flow available for dilution. An accidental spill from a supply or tanker truck is considered to be an unlikely event. In the event of an accidental spill, ASARCO would implement a spill contingency plan (ASARCO, Incorporated 1987-1994).

Impacts to surface water from unlikely accidental spills or ruptures under Alternative II could be potentially significant.

ASARCO has proposed to perpetually discharge adit water to the Clark Fork River. It is assumed that this discharge would be via pipeline. Unless the pipeline was perpetually maintained, eventual pipeline rupture would be probable, which would result in discharge of the water into Rock Creek near the point of rupture. Because of the lower hardness and less dilution capacity of Rock Creek, such a discharge may result in exceedence of standards in Rock Creek even though the same water would not violate standards in the Clark Fork River.

Sedimentation. Construction activities or mass failure of cuts, fills, embankments and soil stockpiles may temporarily increase sediment loading to Rock Creek and the Clark Fork River. Any increased sedimentation would be of short duration. See Aquatics/Fisheries for discussion on impacts from sedimentation to aquatic life.

Estimated sediment yield at the mouth of Rock Creek for the period 1995 to 2006 is presented in **Table 4-21**. These estimates are intended to indicate land use trends or to compare management alternatives. Actual sediment loading to Rock Creek would depend on weather conditions at the time of construction and the efficiency of best management practices (BMPs) used to control erosion. The analysis in **Table 4-21** suggests that proposed mining and logging activities may temporarily increase TSS in Rock Creek between 30 percent and 140 percent over the baseline period of measurement. However, since baseline conditions were generally less than 1 mg/L and typically did not exceed 7 mg/L of TSS, the resulting increase in TSS during the construction phase of the proposed project would remain below 20 mg/L. In addition, loading of TSS would be seasonally dependent. Potential increases in sediment loading to the Clark Fork River below Noxon Dam would be negligible because of the additional volume of flow available for dilution.

TABLE 4-21.
Estimated Effect of Sediment Loading to Rock Creek

Activities				Sediment Loading			
Approximate Acreage Disturbed				Without BMPs		With BMPs	
Year	ASARCO's Proposed Project	Forest Service Timber Activity	Total	Yield (Tons/yr)	Increase in TSS (%)	Yield (Tons/yr)	Increase in TSS (%)
1995	0	83	83	106	30	87	7
1999	25	78	103	111	36	88	9
1997	75	78	153	124	53	92	13
1999	350	40	390	194	140	108	33
1999	50	78	128	118	46	90	11
2000	0	117	117	115	42	89	10
2001	0	117	117	115	42	89	10
2002	0	0	0	81	0	88	0
2004	0	0	0	81	0	81	0
2004	0	0	0	81	0	81	0
2005	0	0	0	81	0	81	0
2006	0	0	0	81	0	81	0

Note: The concentration of TSS during the baseline period of measurement was generally less than 1 mg/L, and no more than 7 mg/L during high events (see Chapter III, Hydrology).

The KNF timber sale currently projected in the Rock Creek watershed potentially may increase peak flows and sediment loading. The amount of these peak flow increases would depend on timing and site- specific information that is unknown at this time. KNF requires the implementation of BMPs during logging operations. If these practices were properly implemented and maintained, then additional sediment transport into the drainages would be minimized.

Tailings Impoundment Failure. The Agencies would institute a process to review and evaluate ASARCO's final tailings impoundment design to ensure long-term stability, and minimize the probability of failure. Catastrophic failure of the tailings impoundment is considered a low-probability event (see Geotechnical Engineering). Should such a failure occur, sediment and tailings leachate would be uncontrollably released to the environment. The volume of material released and the effect of this release on the environment cannot be predicted, and would depend on the type of failure, size of the tailings impoundment at the time of failure, volume of water associated with the failure, and the initial volume and character of the sediments.

Under the worst case scenario, tailing liquids containing dissolved metals and reagent residues, and large masses of sediment would flush into stream channels associated with Rock Creek and the Clark Fork River. Portions of this sediment mass would probably remain in these stream channels for an undefined period of time following failure, while the liquid and remaining solids would be carried downstream. (See Johns and Moore 1985, Workman 1985, Moore, Luoma, and Peters 1991, and Wright and Solero 1973 for discussion of heavy metals movement through natural and human-made impoundments). Subsequent to any such failure, seasonal high flows would continue to wash most of the remaining sediment downstream, and this sediment would be deposited in Cabinet Gorge Reservoir upstream of the dam. Sediment and soluble metals and nutrients also would migrate downstream into Lake Pend Oreille. Most of the fine sediments from any such catastrophic failure would probably not persist in the Rock Creek system for many years. Suspended sediment also would move downstream and settle out in Lake Pend Oreille.

Impacts to Rock Creek and the Clark Fork River to Lake Pend Oreille from a tailings impoundment failure under Alternative II would be significant in the short term and potentially significant in the long term.

Lake Pend Oreille. Nutrients would undergo biological uptake and processing in approximately 18.5 miles of the Clark Fork River between the discharge near Noxon and the state line. Idaho water quality standards for nutrients are not guided by specific criteria, but are regulated by narrative criteria that prohibit impairment of a beneficial use. Change in trophic state (the degree of eutrophication (ageing) of a lake), is used to demonstrate impairment of a beneficial use. If the current oligotrophic (low nutrient) status is maintained, then impairment to a beneficial use cannot be demonstrated.

To analyze the impact from the proposed discharge, Idaho Division of Environmental Quality (IDEQ) estimated the attenuation of nitrogen along the Montana reach of the Clark Fork River. The amount of nitrogen expected to reach Lake Pend Oreille was then compared with a nutrient load/lake response model developed by Woods (1991). Based on this comparison, IDEQ concluded that some lake response may occur as a result of the proposed discharge, but trophic state would likely be maintained since the increase in nitrogen is less than 25 percent (June Bergquist, Idaho Division of Environmental Quality, in a letter to Kathleen Johnson, July 15, 1994).

Although phosphorous is also a limiting nutrient in Lake Pend Oreille, there is not enough information available to estimate gradual reductions of phosphorous between the mine water discharge point in the Clark Fork River and the lake. Nitrogen was chosen because it would be present in much higher levels than other nutrients due to the use of ammoniated blasting agents in the mine, and because sufficient information exists to calculate a rough estimate of nitrogen reductions.

Alternative III

The Agencies' modifications to ASARCO's proposal include measures to mitigate impacts and increase monitoring. In some cases, there is no residual impact to mitigate, but mitigation or additional monitoring has been proposed to address the uncertainties in the hydrologic or hydrogeologic analyses. In these cases, the intent of the mitigation is to either 1) reduce risk associated with the possibility of a potential impact occurring, or 2) collect additional data during the operation of the proposed project to verify the analyses and conclusions presented in the EIS. For example, estimates of surface or ground water flow, and results of mass balances may be under- or over-predicted. A mitigation is proposed to collect additional water balance data. These data could be used to verify the estimate of required underground storage. Based on these data, the size of the underground storage reservoir could be adjusted.

Ground Water Quantity

Operations of the tailings impoundment is expected to result in seepage to a ground water mixing zone. Reducing the total volume of seepage before it mixed with ground water would be more protective than capturing diluted seepage in the perimeter collection system. Under Alternative III, if soft foundation clays were excavated beneath the location of the proposed tailings impoundment embankment, then they could be used to seal the colluvium at the north end of the proposed tailings impoundment and other areas of the impoundment footprint that would be underlain by higher permeability materials. This mitigation would reduce tailings seepage and reduce the volume of water reaching the ground water mixing zone.

Under Alternative III, the use of alternative mechanisms to reduce seepage would be investigated. An engineering study to assess the technical feasibility of the selected alternative would be conducted prior to the 30 percent design for the tailings impoundment. An alternative design could potentially eliminate seepage to the underlying ground water system, and the need to pump seepage for a lengthy period of time after mine closure. This mitigation would thereby provide options to reduce seepage.

Operational data for predicting the potential for acid mine drainage could not be collected until mining commenced. Under Alternative III, acid-generating potential of the waste rock and tailings would be investigated during exploration and adit construction, and these materials would be monitored throughout mine life. If necessary, waste rock and/or tailings impoundment covers would be modified to prevent acid rock drainage prior to reclamation of these facilities. Such modifications may include increasing soil thicknesses or placing a barrier layer (clay or synthetic) beneath the soil to restrict infiltration.

Ground Water Quality

The conceptual design for the perimeter collection system is based on preliminary hydrogeologic data. Data collected during additional site characterization would likely result in refinement of initial estimates of hydraulic conductivity and the hydraulic gradient. There is a risk associated with either under- or over-predicting hydraulic estimates. To reduce this risk, the perimeter collection system performance and efficiency would be modified as additional hydrogeologic data were collected. An "observational approach" would be used for the installation of the proposed seepage interception system. An initial set of wells would be installed, and additional wells would be installed as needed based on monitoring results and a program of aquifer testing. This mitigation would ensure the proper number of wells, well spacing, and discharge rates are used.

Impacts to ground water quality within the mixing zone under Alternative III would be minor to moderate in the short term and minor in the long term.

Surface Water Quantity

Limited data are available about the degree of fracturing and competency of rock in, and surrounding the mineralized zone. Therefore, predicting subsidence impacts, or predicting the impact of mining on surface water features using existing data would be difficult. Under Alternative III, ASARCO would develop a plan to collect additional data that would be used to develop a plan to reduce the risk of subsidence (see Geology), and reduce the risk of impacting surface water features in the CMW. Rock mechanics and hydrogeologic data (rate of inflow, degree of fracturing, static water levels) collected during development of the exploration adit would be used by ASARCO and the Agencies to evaluate, and if necessary, modify the proposed mining plan to avoid potential impacts to lakes in the CMW. This mitigation would decrease the potential for surface subsidence and alteration of the flow regime.

Surface Water Quality

The use of passive biotreatment cells to treat mine discharge containing nitrates and metals is not a proven technology at the flow rates estimated for the proposed Rock Creek Project. Therefore, there is some risk associated with system treatment failure, and a contingency method of treatment is proposed under Alternative III. ASARCO would develop a contingency for the treatment of excess project water. This contingency could include expanding an engineered water treatment plant or the ion exchange treatment facility proposed under Alternative II. This mitigation would ensure that proposed discharge limits for the proposed project would be met.

Elements of the proposed project water balance have been estimated. These estimates may be under- or over predicted. Therefore, estimates of impacts that rely on these estimates also may be under- or over predicted. For example, if mine inflows were less than anticipated, more make-up water may be required. If mine inflows were more than anticipated, higher volumes of discharge to the Clark Fork River would be required, and resultant water quality could be poorer than estimated. If the rate of seepage from the impoundment has been underestimated, more water would require pump back from the perimeter collection system. Operational water balance data would be collected under Alternative III in order to verify the analyses provided in the EIS, and to modify components of the project, if necessary.

Long-term monitoring and water treatment likely would be required for the proposed project. There is risk that a funding mechanism would not be available. Under Alternative III, this risk would be eliminated. The Agencies would establish a mechanism for retaining financial assurance for long-term monitoring, maintenance, and possible perpetual water treatment. This mitigation would assure that public funds such as EPA administered Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) funding or state abandoned mine program funding would not be needed for water treatment at this site.

Under Alternative III, ASARCO and the Agencies would identify up to 130 acres of land in the Bull River and Rock Creek drainages that currently exhibit a high potential for soil erosion, slumping, and mass failure. This acreage would be identified by a field survey completed by ASARCO and the Agencies. Areas identified through this survey would also likely contribute the highest sediment loading to the Bull River and Rock Creek. After these areas have been identified, ASARCO would take action to implement best management practices to reduce erosion, slumping, or mass failures from these areas prior to construction of the mine. It is assumed that of the 130 acres identified, at least 65 acres would be selected in the Rock Creek drainage, and the remainder would be located in the Bull River drainage. Implementation of selected BMPs in these areas would have the effect of reducing existing sediment loading to Rock Creek and the Bull River. The reduction in sediment loading and subsequent impact on total suspended sediment cannot be quantified, and would vary depending on weather conditions and the degree and magnitude of precipitation.

Implementation of KNF-proposed timber sales in the Rock Creek drainage during mining may be modified or postponed until after the proposed mine was reclaimed based on other environmental factors such as available open road density or the amount of effective grizzly bear habitat. Any reduction in timber sale-associated road construction would reduce the potential for erosion and sediment loading to Rock Creek.

There are risks associated with predicting the potential for acid drainage using existing baseline data. More accurate predictions could be developed only after exploration and mining commences. Under Alternative III, additional data would be collected to reduce the associated risk. ASARCO would perform additional sampling and testing, including kinetic geochemical testing to reduce the uncertainties associated with acid drainage prediction. These tests would provide additional information to predict the potential for long-term acid drainage, and to assess the acid drainage potential of waste rock prior to its use as construction material. This mitigation would reduce the risk of acid mine drainage.

In addition, ASARCO would develop a representative underground sampling and acid-base testing program. This information would be used along with water monitoring data to predict postmining water quality. Kinetic test results of adit and mine waste rock proposed for use in plant site or tailings impoundment construction would be provided to the Agencies prior to the rock being used for construction. If this material is acid generating, it would not be used for construction purposes, but would be segregated for special handling. This mitigation would help ensure that acid generating material is not used for construction purposes. Adverse effects to water quality would be avoided by not using acid generating material for construction purposes.

Design of the passive biotreatment cells has not, as yet, (January 9, 1995) been reviewed by the Agencies. There is concern that this treatment system could result in waste that would be buried in place after the cells were no longer used. Under Alternative III, the design of the cells and options for reclamation would be reviewed and approved by the Agencies. The characteristics of the contents of the passive biotreatment cell, and whether the cell ultimately contained a hazardous waste would be identified. Disposal options for the cell contents at the end of mine life would be evaluated and approved by the Agencies.

Monitoring

Under Alternative III, a "Monitoring Alert Levels and Contingency/Corrective Action Plan" would be developed by ASARCO for the project. This plan would ensure early detection of potential environmental degradation or impairment, and would focus primarily on the protection of surface and ground water resources. Using this plan, early controls could be initiated to avoid development of nuisance or toxic conditions. The intent of the plan would be to prevent pollution and other problems before they occurred.

ASARCO would finalize a comprehensive, long-term monitoring program. Data collected from the monitoring program would be reviewed to evaluate the extent and magnitude of impacts during the proposed project's construction, operation, and postoperational periods. The information from the monitoring would be used to guide subsequent operating and monitoring requirements. Operational monitoring would begin during the first quarter of construction of the exploration adit and would be maintained during the life of the project. Postoperational monitoring would be carried out until water quality returned to allowable levels under water quality standards. ASARCO would also fund a half-time technical position at DSL to evaluate the results of monitoring and act as a liaison between ASARCO and the Agencies. This mitigation would increase the ability to detect and quickly correct potential environmental problems.

The Agencies would require extensive monitoring of operational flows and discharges because of uncertainties in the operational water balance and the discharge rates. If observed discharges were greater than currently estimated, a new loading analysis would be performed to determine if additional mitigations would be required.

Alternative IV

Surface water and ground water impacts associated with locating the mill site at the confluence of East and West forks of Rock Creek would be identical to impacts associated with Alternative III, with some exceptions. First, there would be less potential for supply truck spills or slurry and return water pipeline breaks because the hauling distance to the mill would be less, and the pipe between the mill and the tailings impoundment would be shorter. Second, because the mill would be located farther downstream, suspended sediment produced from the construction of the mill facility and residual nitrogen from blasting would not effect the West Fork of Rock Creek. In addition, the 300-foot buffer zone between the confluence mill site and both forks of Rock Creek would reduce sediment reaching surface waters by an unknown amount. Ground water inflow to the adit was evaluated and is presented in **Table 4-22**. Estimated inflow for the proposed project and the alternatives is provided in **Table 4-23**.

TABLE 4-22.
Ground Water Inflow to Conveyor/Service Adits - Confluence Mill Site Mine Portal

Adit Segment (ft)	Adit to Ground Surface (ft)	Hydraulic Head (ft)	Assumed Hydraulic Conductivity (ft/min)	Calculated Inflow Per Foot (gpm/ft)	Segment Inflow (gpm)	Cumulative Inflow (gpm)
0 - 1,000	175	0	1.13×10^{-5}	0	0.0	0.0
1,000 - 2,000	530	30	1.13×10^{-6}	0.0299	29.9	29.9
2,000 - 3,000	793	293	1.13×10^{-5}	0.0521	52.1	82.0
3,000 - 4,000	868	368	1.13×10^{-6}	0.0397	39.7	121.7
4,000 - 5,000	860	360	1.13×10^{-5}	0.0380	38.0	159.7
5,000 - 6,000	918	418	1.13×10^{-6}	0.0587	58.7	218.5
6,000 - 7,000	1,088	588	1.13×10^{-6}	0.0081	8.[illegible]	226.6
7,000 - 8,000	1,350	850	1.13×10^{-6}	0.0091	9.1	235.7
6,000 - 7,000	1,113	1,113	1.13×10^{-6}	0.0100	10.0	245.7
9,000 - 10,000	1,788	1,[illegible]88	1.13×10^{-6}	0.0115	11.5	257.3
10,000 - 11,000	1,800	1,300	1.13×10^{-6}	0.0136	13.8	270.9
11,000 - 12,000	1,788	1,300	$1.13 \text{ X } 10^{-6}$	0.0138	13.8	289.8
12,000 - 13,000	1,963	1,463	$1.13 \text{ X } 10^{-6}$	0.0152	15.2	305.0
13,000 - 14,000	2,113	1,613	$1.13 \text{ X } 10^{-7}$	0.0016	1.6	306.6
14,000 - 15,000	2,125	1,625	$1.13 \text{ X } 10^{-7}$	0.0017	1.7	308.3
15,000 - 15,530	2,038	1,538	1.13×10^{-6}	0.0150	15.0	285.8

Source: ASARCO, Incorporated 1987-1994.

TABLE 4-23.
Estimated Ground Water Inflows for Alternative IV

Rock Creek Forks Portal Site	Inflow in gpm (no safety factor)	Inflow in gpm (safety factor applied)
Evaluation Adit	112	168
Conveyor and Service Adits	286	429
Ore Body Area	825	1,650
Total Inflow	1,223	2,247

Source: ASARCO, Incorporated 1987-1994.

Cumulative Impacts

The KNF timber sales currently projected in the Rock Creek watershed and unknown private logging potentially may increase peak flows. The amount of these peak flow increases would depend on timing and site specific information that are unknown at this time. Additional sediment could reach Rock Creek and the Clark Fork River from logging and road construction activities. The KNF requires the implementation of BMPs during logging operations. If these practices were properly implemented and maintained, then additional sediment transport into the drainages would be minimized. Proposed highway construction also may increase sediment reaching streams potentially affected by the ASARCO Project.

No cumulative impacts would occur to ground water in the project area. The impacts of the proposed project would be limited to the vicinity of the project area, and the Rock Creek tailings impoundment site. No ground water effects would result from the proposed KNF timber sales. The Montanore Project includes underground mining and would affect bedrock ground water systems east of the proposed Rock Creek Project. However, it does not appear likely that the two operations would have any cumulative effects on ground water quantity or quality.

WATERS OF THE U.S. AND WETLANDS

Summary

None of the alternatives would affect more than 1.5 acres of Waters of the U.S. Variable amounts of wetlands are affected but no more than 8.1 acres under any alternative.

Nearly 1 acre (part of the total 5.4 acres) of wetlands associated with the proposed tailings impoundment site for all action alternatives would be indirectly affected by the capture of surface water by the tailings impoundment and the surface and ground water capture of the proposed tailings impoundment seepage collection system. The total drainage area contributing to wetlands would be reduced, potentially reducing the duration of saturation, inundation, and ponding of water in this area. Decreased surface and ground water flow, especially during the growing season or dry periods, would allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions.

Sediment would temporarily increase in Waters of the U.S. and wetlands during construction under all action alternatives. Proposed BMPs would help reduce sedimentation. Mitigations under alternatives III and IV would further reduce sedimentation in Rock Creek.

ASARCO has proposed a mitigation plan (ASARCO, Incorporated 1993) to create about 12.3 wetland acres to compensate for the loss of approximately 8.1 wetland acres. Under ASARCO's proposed wetland mitigation plan, about 1.8 acres of wetlands would be created on the uphill side of a newly constructed segment of the main access road. Under alternatives III and IV, these 1.8 acres of proposed mitigated wetlands would need to be relocated to more hydrologically suitable locations because the main access road would be rerouted to higher and drier terrain.

The functions and values of the wetlands impacted by the Rock Creek mine would be destroyed or reduced. The definitive wetland mitigation ratio (acres mitigated per acre destroyed) and specific wetland mitigation designs and locations have not been approved by the U.S. Army Corps of Engineers (COE). Replacement (mitigated) wetland functions and values would be monitored during mining to evaluate the success of re-establishing functions and values of wetlands destroyed.

General Introduction

The proposed project would affect Waters of the U.S. and wetlands in the mill site, waste rock dump, access roads, utility corridors, topsoil stockpiles, diversion ditches, and tailings impoundment areas (see **Table 4-24**).

In general, the functions and values of wetlands impacted by the Rock Creek project may be considered limited for regional importance because wetlands commonly occur throughout the region and their loss would not limit aquatic or wildlife habitat for the region. In addition, the proposed wetland mitigation would create wetlands that would re-establish similar wetland functions and values. Site-specific importance was rated high for aquatic and wildlife diversity and abundance. Other wetland functions and values discussed in Chapter 3 were rated as having only moderate to low importance.

Alternative I

Waters of the U.S. and wetlands are located along Rock Creek, its tributaries, and along the ephemeral and intermittent drainages of Miller Gulch. These Waters of the U.S. and wetlands would be impacted under Alternative I as a result of the projected timber harvests; potential land exchanges; probable increase recreational use, including hunting, fishing, camping, and recreational driving; and the Montanore Mine. These impacts may decrease the amount of Waters of the U.S. and wetlands, increase erosion and sedimentation in the Rock Creek drainage by some amount, and reduce their ecological functions. The most important wetland functions are considered to be their role in providing aquatic and wildlife diversity and abundance.

Alternative II

Construction of ASARCO's proposed mill site, mine waste rock dump, tailings impoundment, and associated facilities would affect a total of 5.8 acres of wetlands by the direct placement of fill, and an additional 2.3 acres of wetlands by modifying existing hydrology. Surface water flow would be reduced in wetlands downstream of both the proposed waste rock dump and mill site from the diversion of runoff. At the mill site, surface water would be conveyed through the area in lined ditches. Construction of utility corridors and of the new segment of FDR No. 150 from Montana Highway 200 would require filling wetlands. Construction and operation of the tailings impoundment would cause the largest impacts to wetlands resulting in the direct loss of about 4.4 acres and an indirect loss of about 1.0 acres (see **Table 4-24**).

TABLE 4-24.
Acreage of Wetlands and Waters of the U.S. Affected by Proposed and Alternative Facilities

ALTERNATIVE IMPACTS	Wetlands (acres)		Waters of the U.S. (acres)	
	Direct	Indirect	Direct	Indirect
ALTERNATIVE II				
ASARCO mill site area	0.3	0.0	1.1	0.0
ASARCO mill site waste rock dump	0.6	1.3	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1[1]	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.4	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative II Totals	**5.8**	**2.3**	**1.5**	**0.0**
ALTERNATIVE III				
ASARCO mill site area	0.3	0.0	1.1	0.0
Alternative mine waste rock dump	0.0	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.4	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative III Totals	**5.2**	**1.0**	**1.5**	**0.0**
ALTERNATIVE IV				
Confluence Mill Site and Waste Rock Dump	<0.1	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	5.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.4	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative IV Totals	**5.0**	**1.0**	**0.4**	**0.0**

[1] <0.1 acres rounded up to 0.1 acres for acreage totals

About 1.1 acres of Waters of the U.S. would be directly affected by the construction of lined channels to route existing drainage flow through the mill site. Another 0.4 acres of Waters of the U.S. would be directly affected by utility corridors and upgrading of the main access road.

About 4.4 acres of wetlands located under the proposed tailings impoundment would be destroyed by direct filling with tailings materials. These wetland areas are associated primarily with ephemeral drainages of the south fork of Miller Gulch and occur in subtle surface depressions along the broad shallow grassy swales. Saturated soils are caused by shallow perched water in surficial clays. Static water levels in nearby monitoring wells indicate that the water table is about 20 feet beneath ground surface. Wetlands vegetation in this area is dominated by herbaceous species including sedge and rush species. The functions and values associated with these wetlands would be destroyed. Loss of these functions and values would be significant.

Immediately downgradient of the proposed tailings impoundment, about 1 acre of wetland would be indirectly affected by the capture of surface water by the tailings impoundment, and the surface and ground water capture of the proposed tailings impoundment seepage collection system. The total drainage area contributing to downstream wetlands would be reduced under Alternative II, potentially reducing the frequency and duration of saturation, inundation, and ponding of water for some wetlands. Decreased surface and ground water flows, especially during the growing season or dry periods, may allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions. This may result in a reduction in wetland functions, primarily from the loss of wildlife habitat diversity.

Sediment contributions would temporarily increase to Waters of the U.S. and wetlands during construction of the proposed mill site, roads, and tailings impoundment. BMPs would reduce sediment contributions to Waters of the U.S. and wetlands.

Impacts to Waters of the U.S. and wetlands under Alternative II would be potentially significant.

Wetlands Mitigation Plan

In compliance with Section 404(b)(1) of the Clean Water Act, ASARCO has proposed a mitigation plan providing mitigation and compensation for the loss and potential diminishment of wetland functions and values associated with development of the proposed project (ASARCO, Incorporated 1993). A summary of ASARCO's proposed wetlands mitigation plan is found in Chapter 2. In its wetlands mitigation plan, ASARCO proposes to create 12.3 acres of wetlands to compensate for a wetlands loss of about 8.1 acres. About 1.5 acres of Waters of the U.S. (primarily without vegetated wetlands) would be affected by the proposed project and would be mitigated by creating 1.5 acres of Waters of the U.S. on site during final reclamation. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek, and attenuate peak flows.

ASARCO identified four possible wetland mitigation areas and one Waters of the U.S. mitigation site (see **Figure 2-21**). The proposed acreages and mitigation schedules for the created wetlands and Waters of the U.S. are provided in **Table 2-5**. Detailed descriptions, including site development, design specifications, and schedules, are presented in ASARCO's wetlands mitigation plan (ASARCO, Incorporated 1993). The proposed wetlands and Waters of the U.S. mitigation consists of creating: 1) 7.5 acres of wetlands at borrow area 3; 2) 1.8 acres of wetlands at the access road sites; 3) 1.2 acres of wetlands at the Miller Gulch sites; 4) 1.8 acres of wetlands at the Rock Creek sites; and 5) 1.5 acres of Waters of the U.S. at the proposed mill site. All proposed wetland and Waters of the U.S. mitigation sites are within the proposed permit boundary.

The technique of controlling wetland hydrology through elevated culverts and standpipes has been used successfully at numerous wetland construction projects. The proposed wetland mitigation could reestablish wetland functions and values to compensate for the loss and potential diminishment of wetland functions and values associated with development of the mine.

Alternative III

The effects of Alternative III on Waters of the U.S. and wetlands resources would be the same as those described under Alternative II, except for the following. The 1.5 acres of Waters of the U.S. would be diverted in channels constructed to retain their functions and values during mine operations. Relocation of the waste rock dump at ASARCO's mill site to a location with no delineated wetlands would result in 1.9 fewer acres of wetlands directly and indirectly impacted (see **Table 4-24**). In addition, because the new 6,300-foot segment of FDR No. 150 would be relocated to higher and drier terrain, the methodology for creating wetland mitigation sites on the uphill side of the FDR No. 150 would need to be changed. The proposed wetland mitigation sites could still be located in the vicinity, however, small retention dikes across the drainageways would need to be constructed using alternative methods. Other locations within the riparian areas along Rock Creek and within the proposed permit area also may have the necessary wetland hydrologic characteristics to replace proposed access road mitigation sites.

Impacts to Waters of the U.S. and wetlands under Alternative III would be potentially significant.

Alternative IV

Implementation of Alternative IV would result in the loss of about 6 acres of wetlands and 0.4 acres of Waters of the U.S. This alternative would result in the least impacts to Waters of the U.S. and wetlands of all the action alternatives. The confluence mill site would be located on a relatively flat, upland containing only three small wetlands (total < 0.1 acres) and no Waters of the U.S.

Surface runoff from undisturbed hillsides above the mill facilities and patio area would be diverted through the mill site and discharged into the natural channel that drains into the East Fork of Rock Creek. The diversion would be designed to handle the 100-year rain-on-snow event, but still retain premine functions and values. Relocation of the new segment of FDR No. 150 would result in the need to modify the mitigation methodology or relocate FDR No. 150 wetland mitigation sites.

Impacts to Waters of the U.S. and wetlands under Alternative IV would be potentially significant.

Cumulative Impacts

The impacts of the proposed project combined with impacts from the Montanore Mine and projected timber sales in the Rock Creek drainage may decrease the amount of Waters of the U.S. and wetlands and their ecological function. Aquatic and wildlife diversity and abundance are the two most important functions of Waters of the U.S. and wetlands. The wetland mitigation plans could create wetland conditions that would re-establish wetland functions to compensate for the loss and potential diminishment of habitat diversity and abundance. Under alternatives III and IV, timber sales or associated road construction on KNF lands within the Rock Creek drainage may be reduced in scope and number until after mine closure, thus reducing the cumulative impacts to Waters of the U.S. and wetlands. Cumulative impacts under all action alternatives would be potentially significant. However, Alternative IV would result in the least impacts to Waters of the U.S. and wetlands.

AQUATICS/FISHERIES

Summary

Some impacts to water quality are possible as a result of mine construction and operation for all action alternatives. Impacts to water quality may affect fish and aquatic macroinvertebrates and plants. The impacts may include a reduction in numbers of individual organisms, a change in species composition, a reduction in species diversity, or a combination of the above. In general, all action alternatives would have these potential impacts. However, Alternative II tends to have the greatest impacts, and Alternative IV the least.

Catastrophic failure of the tailings impoundment would have potentially disastrous consequences for aquatic life in downstream water bodies under any action alternative.

Spills of fuels, chemicals, concentrate, or reagents could occur and have toxic effects on aquatic life if they reached water. Such events would be rare and impacts relatively short-lived. Long-term impacts would depend on the quantity and toxicity of spilled materials.

A slurry, waste water, or reclaim water pipeline rupture could result in tailings, mine adit waste water, or reclaimed water from the tailings impoundment, polluting Rock Creek. The extent of harm depends on quantity and toxicity of tailings or waste water entering the stream, the flow of the stream at the time of the spill, and the spill's location. Risks to the Clark Fork River are somewhat less than to Rock Creek because of the dilution potential of the larger water body. The potential for tailings pipeline rupture and spills in the West Fork of Rock Creek would be eliminated under Alternative IV.

Clearing in the Rock Creek riparian zone for road, slurry line, and powerline construction could increase streambed sediments and water temperatures. Stream habitat would be directly altered by construction of the mill site, bridges, utility corridors, and pipeline crossings.

If mining impacts reduced water levels in the wilderness lakes, amphibians and other aquatic life would be impacted. There are no known fish populations in these lakes. The potential for subsidence-related impacts to water levels and aquatic life in these lakes would be reduced under alternatives III and IV.

Aquatic habitat degradation could result in non-native fish gaining a competitive advantage over the native species. Brook trout are the primary threat. They interbreed with bull trout and the offspring are sterile. It is generally believed that such a mating is detrimental to bull trout populations. Mitigation in Rock Creek drainage and Bull River under alternatives III and IV would reduce the risk of interbreeding and non-native fish increase, while improving the status of bull and cutthroat trout in Rock Creek and enhancing the viability of Cabinet Gorge bull trout stock.

Increased recreational use and access in the area could result in increased fishing pressure. Potential impacts to Rock Creek from increased fishing pressure would be minimal.

Alternative I

Aquatic resources would change over time due to natural cycles. A Forest Service timber sale is planned for the project area. Road construction associated with this sale and other timber sales or development on private land in the drainage could impact fisheries resources by increasing sediment loads, changing flow patterns, and increasing water temperatures. Migratory bull trout in Cabinet Gorge Reservoir and Rock Creek could be harmed if deposited sediment in spawning areas increased. Impacts to aquatics/fisheries resources in Rock Creek under Alternative I would be significant if deposited sediments were increased.

Alternative II

Aquatic Habitat

Spills and Impoundment Failure. If the slurry, waste water, or reclaim water pipeline ruptured it could result in tailings, mine adit waste water, and/or reclaimed water from the tailings impoundment reaching surface waters. The extent of harm this would cause depends on the amount and toxicity of tailings or waste water actually reaching the stream and streamflow at the time of the spill. Location of the spill would also be important -- the further upstream the spill, the greater portion of Rock Creek potentially impacted. The risks to the Clark Fork River are somewhat less because of the dilution potential of the large water body and higher hardness of the river water.

Research done by Hansen (1990) on the short-term impacts of Troy Mine on Lake Creek found that the abundance of ten taxa of aquatic macroinvertebrates downstream of the Troy Mine tailings impoundment was significantly different relative to upstream control stations and to the premining baseline period. All of the differences appeared to be attributable to tailings contamination.

However, his research was confounded by the tailings spill in 1984 that directly contaminated the downstream study area during the study period. ASARCO's Troy Mine suffered a tailings slurry line spill in 1984, resulting in about 400 tons of mine tailings entering Lake Creek (Jones 1984). It was not possible to separate the effects of the tailings impoundment seepage from the tailings spill, although it was assumed that the spill was of much greater influence. None of the biotic changes in Lake Creek up to July 1985 appeared to be extreme enough to risk local extinction. Research on Lake Creek since 1986 indicates no major long-term impacts to macroinvertebrates from the tailings spill or tailings impoundment seepage (Volosin, MacLellen, and Cardwel 1994). The long-term impacts to Lake Creek from this accident appear to be negligible. Although ASARCO is proposing several safety features to reduce the likelihood of spills (including emergency dump impoundments and pipeline sensors), the possibility of accidents cannot be eliminated.

Some of the reagents proposed for use in the milling process are known to be toxic to aquatic organisms. (Annual consumption of reagents is listed in **Appendix F**.) The acute toxicity of potassium amyl xanthate to rainbow trout is 18 - 56 ppm (Webb, Ruber, and Leduc 1976). Chronic toxicity testing (static type test) found 100 percent mortality of rainbow trout exposed to a concentration of 56 ppm potassium amyl xanthate for less than 4 days. However, it should be noted that in flow-through toxicity tests which better approach natural conditions, toxicity of xanthates was on the order of 100-fold greater compared with the static toxicity test results (Webb, Ruber, and Leduc 1976).

However, Webb, Ruber, and Leduc (1976) state that xanthates are potentially harmful to rainbow trout populations at concentrations that may be encountered in receiving waters near mining operations. They cite research that found xanthates in tailings effluent in the range of 0.2 - 4.0 ppm. Xanthate residues at this level in the tailings would be cause for concern if tailings were to leak or be spilled in Rock Creek.

a-Terpinal (pine oil) has an acute toxicity (LC_{50}) to rainbow trout in concentrations of 10 ppm (Webb, Rubar, and Leduc 1976). Dow 250 (Polypropylene glycol) is relatively non-toxic to rainbow trout ($LC_{50} > 1000$ ppm) (Webb, Rubar, and Leduc 1976). The toxicity to aquatic life of the other reagents (Am Cy Superfloc S-5S95 and Ozana A) to be used in the mill (**Appendix F**) are unknown.

The most likely, but still improbable, chemical accident would be a spill of one of the processing reagents into a stream while being hauled by truck to the mill site. Total truck traffic during operation is estimated to be 30 ADT (see Transportation). It is possible that such an event could cause a fish kill and eliminate the aquatic macroinvertebrate and algae community in the vicinity of the spill. Such events would be rare and impacts relatively short term.

Concentrate would contain copper, silver, and residues from processing and would be shipped from the mill to the railroad in trucks. If a truck were to have an accident, or a train were to derail, concentrate could spill into Rock Creek or the Clark Fork River. The effects of such an accident are impossible to quantify. However, both copper and silver are toxic to fish. Silver is one of the most toxic metals to aquatic life (Phillips and Russo 1978). Impacts to aquatics/fisheries from accidental spills could be potentially significant depending on the variables mentioned above and material spilled.

Of the several low-probability events that could have an impact on aquatic ecosystems, the least likely but most catastrophic would be a failure of the tailings impoundment (see Geotechnical Engineering and Hydrology). If this were to occur, sediments and tailings leachate would be uncontrollably released into Rock Creek and the Clark Fork River.

Water quality degradation associated with the unlikely event of an impoundment failure is discussed in Hydrology. The toxicity of ammonia, nitrate, copper, and lead (pollutants found in the tailings) to aquatic life depends on a number of variables including, but not limited to, concentration, temperature, hardness, and pH. Therefore, the impacts to aquatic life in the event of an impoundment failure cannot be accurately predicted.

At the Troy Mine, acute toxicity tests have been conducted with tailings pond water and *Daphnia magna* (an invertebrate test organism) during the mine operation and current shutdown. From the start of the operation to the summer of year 8 (1989), acute toxicity (death of 50 percent or more *Daphnia*) occurred in only 1 of 23 tests. Since the fall of year 8, the tailings water was acutely toxic in 15 of 19 tests. Toxicity during the latter part of the operation is believed to be caused primarily by elevated levels of ammonia, copper and other metals (ASARCO, Incorporated, 1981-1994). Based on the Troy toxicity data, it is likely that the Rock Creek impoundment tailings water would be toxic to aquatic life in the event of an impoundment failure, especially if the failure occurred a few years after the operation began.

However, in general, the impact to the lower 1.0 mile of Rock Creek would be the most severe because of the relatively low flow and soft water in Rock Creek. The Clark Fork River contains harder water and is therefore somewhat less sensitive to metals pollution. In addition, the substantially larger flow of the Clark Fork River results in significant dilution of pollutants. However, loading of mine-related pollutants would occur in the Clark Fork River.

The tailings liquid, which would have elevated levels of ammonia and nitrate, would impact aquatic life downstream to Lake Pend Oreille. The tailings solids, which would have elevated levels of copper and lead, might not immediately impact aquatic life downstream of Cabinet Gorge Dam. However, eventually tailings solids and their associated pollutants, would impact aquatic life downstream to Lake Pend Oreille.

Impacts to aquatics/fisheries from an impoundment failure could be major and significant in the short term to the lower 1.0 mile of Rock Creek and the Clark Fork River depending on seasonal, locational, and operational variables. Long-term impacts from an impoundment failure would be minor to major and potentially significant depending on the same variables. Aquatic systems downstream to Lake Pend Oreille could experience significant short-term impacts from the addition of nitrate and ammonia in solution. Long-term impacts to Lake Pend Oreille would depend on the rate and quantity of metals and sediments that passed Cabinet Gorge Dam, but could be potentially significant.

Sediment. Assuming the implementation of BMPs, TSS is estimated to increase in Rock Creek between 7 and 33 percent during the exploration and construction phase as a result of the project (see Hydrology). TSS is estimated to average less than 25 mg/L, the level considered by DHES Water Quality Division to be "highly protective" of cold-water fisheries (Montana Department of Health and Environmental Sciences 1988). As disturbed areas revegetated and stabilized, concentrations of suspended sediment would decrease. However, soil disturbed by construction activities would provide favorable sites for the spread of noxious weeds (see Biodiversity). Runoff and sediment yield are higher on sites infested with spotted knapweed (see Chapter 3, Biodiversity).

The impact of increased suspended sediments on fisheries resources can not be quantified at this time. Data indicate that concentration alone is a relatively poor indicator of suspended sediment effects; sediment concentration and duration of exposure is a better indicator of effects (Newcombe and MacDonald 1991). Major impacts (decreased growth rate or increased mortality) to salmonid resources have occurred from exposure to suspended sediment concentrations of less than 25 mg/L (Slaney, Halsey, and Tautz 1977; Sykora, Smith, and Synak 1972). The impacts of suspended sediment on fish in Rock Creek would depend on variables such as the concentration of sediment, duration of exposure, species and life stage of fish exposed, season, streamflow, and water temperature.

The impact of deposited sediment also is difficult to quantify because it is not possible to accurately predict the amount of sediment that would be deposited on the stream bottom. Sediment can reduce the quantity and diversity of aquatic macroinvertebrates, which provide food for salmonids. Decreased aquatic insect populations have been noted below silt outflows (Bjornn et al. 1977; Nuttall and Bielby 1973, and others). The distribution of aquatic macroinvertebrates inhabiting running water environments is highly dependent on substrate particle size (Cummins and Lauf 1969).[4] Increased levels of deposited sediment could reduce the quantity of aquatic macroinvertebrates (the food supply for fish) in Rock Creek in the short term. In addition, a change in species composition may occur, with increases in the abundance of sediment-tolerant species and decreases of abundance of sediment-intolerant species.

Sediment may impact salmonids by impairing the reproductive process. There seems to be substantial evidence that reproductive behavior may be affected by sediment in various ways, including modifications of spawning time, place, and behavior. In addition, sediment deposition on the stream substrate can impair egg and larval growth, development, and survival (Wilber 1983).

On the Flathead National Forest, a 40 percent sediment (less than 0.25 inches) level in bull trout spawning areas is considered to be an upper tolerance limit. Once sediment exceeds that level, no additional sediment loading from new land disturbances is allowed, and a program of sediment-source reduction is undertaken. Very little spawning habitat is available in Rock Creek, and available gravel in mainstem Rock Creek already contains a high level of fine sediment. Any increase in deposited sediment in these spawning substrates would further reduce survival-to-emergence of fry and potentially lead to reduction of fish populations due to reproductive failure. Over time, sediment levels would decline as disturbed areas stabilized and revegetated.

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[4] McClelland and Brusven (1980) found that increased quantities of sediment in laboratory streams filled substrate interstices (the cracks in between the rocks) and reduced the "effective" size of surface cobbles. The sediments effectively eliminated many of the critical static (calm) water areas around cobbles and boulders, reducing insect density. Fine sediments around cobbles produce a "gasket effect" by creating a seal, thereby restricting access to the undersurface of cobbles (Brusven and Prather 1974).

Any sediment that reached Cabinet Gorge Reservoir would likely settle out rapidly. Impacts to habitat in Cabinet Gorge Reservoir from sediment are expected to be insignificant. However, reduced spawning success in Rock Creek could effect fish populations in Cabinet Gorge Reservoir (see Fish).

Deposited sediment impacts to aquatics/fisheries in Rock Creek from Alternative II would be significant if deposited sediments were not flushed. Potential impacts from suspended sediments on aquatics/fisheries under Alternative II would be significant in the short term.

Metals. The Clark Fork River would receive treated mine adit wastewater. The resulting metals loading is described in Hydrology. Metals levels would remain below Montana cold-water aquatic life standards. Impacts to aquatic life under Alternative II from metals loading into the Clark Fork River and Lake Pend Oreille would be negligible. Impacts to Rock Creek from metals loading in the unlikely event of a tailings slurry pipeline rupture could be significant and are discussed under Spills and Impoundment Failure.

Water Temperature. Clearing within riparian areas for construction of the road/utility corridors, borrow areas, and catchment basins would expose areas of the stream channel to direct sunlight, possibly increasing water temperatures and plant growth in those areas. The rise in temperature and related impacts would likely be localized in the aquatic community. Impacts to aquatics/fisheries from temperature increases under Alternative II cannot be quantified in the long term.

Nutrients. Discharge of treated mine water would result in minor increases of nitrogen to the Clark Fork River. However, resulting changes in water quality would be difficult to measure because the nitrogen load would be minor and a large volume of water in the Clark Fork River would be available for dilution (see Hydrology).

After reclamation was complete, the concentration of nitrates and other nitrogen compounds would return to near baseline conditions (see Hydrology). Negligible to minor impacts from nutrients to aquatic life is anticipated under operations in the Clark Fork River and Lake Pend Oreille.

Nitrogen loading to Rock Creek below the proposed exploration adit waste rock dump, mill site, and mine waste rock dump could temporarily increase during construction (see Hydrology). The impact of this loading on aquatic plant communities cannot be quantified, however, the impact would be short term (probably 1 to 5 years). Impacts to the aquatic plant communities from increased nutrients would be potentially significant in the short term.

Aquatic invertebrate populations would respond to changes in the algae community. Aquatic invertebrates may increase in number, species diversity may decrease, and species composition may change. Species that are tolerant to organic pollution (i.e., nitrates) may replace sensitive species. The degree of change would depend on the amount of nutrients and the duration of elevated levels. Impacts to macroinvertebrates from increased nutrients under Alternative II are expected to be significant in the short term.

Stream Habitat Alteration. There would be some direct disturbance of stream habitat of Rock Creek during mine facility construction. Construction of bridges, utility corridors, and pipeline crossings would involve heavy equipment operating in and adjacent to the stream channel resulting in disturbance to the stream substrate and banks. ASARCO's commitment to use of BMPs, and the mitigations required under a 310 permit would minimize these impacts.

Two unnamed tributaries to the West Fork of Rock Creek would be routed around the proposed mill site in lined canals (see Chapter 2, Waters of the U.S. and Wetlands). The conversion of these streams into ditches would result in a reduction of diversity and abundance of aquatic life currently inhabiting these streams. No baseline biological data are available on the upstream tributary (fed by spring SP-3). Aquatic macroinvertebrate sampling at site WRC-4 had the overall highest abundance of macroinvertebrates of any sampling site in the Rock Creek drainage. No data on fisheries are available for either tributary.

Mitigation for the loss of these streams during the construction/operation period would consist of constructing 1.5 acres of Waters of the U.S. in this area during reclamation (see Chapter 4, Waters of the U.S. and Wetlands).

The culvert extension on the West Fork of Rock Creek has the potential to be a barrier to fish passage if installed incorrectly. Reviews during the permitting process should ensure that fish passage was maintained at this location.

Wilderness Lake Water Levels. Impacts to wilderness lakes are unlikely to occur (see Geology and Hydrology). However, it should be noted that if a subsidence-related reduction in surface water levels should occur, the impact to aquatic resources would be significant and possibly irreversible.

Aquatic Invertebrates

The proposed project has the potential to reduce the abundance and diversity of aquatic invertebrates in Rock Creek and the Clark Fork River. Impacts from the project may produce conditions that favor species that are tolerant of sedimentation, nutrient enrichment, and/or metals. In Rock Creek, the primary threats are sediment increases (primarily during project construction), direct loss of habitat (during construction and operation in unnamed tributaries to the West Fork of Rock Creek), nutrient increases (primarily during construction), and spills of toxic materials (primarily during operation).

Fish

The proposed project has the potential to reduce the abundance and diversity of fish in Rock Creek. The primary threats are sediment and nutrient increases (during project construction), spills (primarily during operation), and temperature increases.

Rock Creek is unusual in that several sections of the stream still possess the native fish species complex (westslope cutthroat and bull trout). Both species of native trout (bull and westslope cutthroat) are sensitive to habitat degradation. Brook trout (a non-native species) are generally considered to be more tolerant of sediment and increases in temperatures than are bull or westslope cutthroat trout. Habitat degradation could result in non-native species gaining a competitive advantage over native species. Habitat degradation from the project may be sufficient to cause the loss of the resident bull trout and westslope cutthroat trout in Rock Creek.

Brook trout interbreed with bull trout and their offspring are sterile. It is generally believed that such a mating is detrimental to bull trout populations (Leary, Allendorf, and Knudsen 1983). Therefore, habitat degradation may give brook trout a competitive advantage over bull trout. If this occurred, a significant loss of native species and biodiversity in Rock Creek would result.

Adfluvial (fish that migrate from lakes to streams to spawn) bull trout populations in the Cabinet Gorge Reservoir/lower Clark Fork River ecosystem are low and are at a very high risk of elimination (Thomas 1992). Bull trout populations in Cabinet Gorge Reservoir are supported by two tributaries: Bull River and Rock Creek. Pratt and Huston (1993) characterized this population as stable but fragile. The small number of nursery streams increases the probability that the population would be unable to recover from catastrophic events. In addition, the bull trout population is low enough to put genetic diversity in jeopardy. Given the precarious state of the fish in this system, the loss of Rock Creek as a spawning and rearing tributary could push the bull trout further towards elimination in this drainage.

Impacts to fish under Alternative II could be significant.

Human population changes and improved recreational access in the area (see Socioeconomics) would increase the number of recreationists and anglers near Rock Creek and Clark Fork area near Noxon. The increased numbers of anglers would primarily focus on Noxon and Cabinet Gorge reservoirs (see Recreation).

Human Consumption of Fish

Mine water discharge into the Clark Fork River has a low potential to increase heavy metal concentrations in fish tissues because this water would meet Montana water quality standards. Therefore, fish consumption would not pose a risk to human health.

Alternative III

Aquatic Habitat

Spills and Impoundment Failure. Routing the slurry line along a major travel corridor would reduce the risk that a pipeline leak would go undetected but would not affect the impacts if a spill occurred. Potential impacts to aquatic habitat from spills and accidents under Alternative III would be potentially significant depending on a variety of variables discussed under Alternative II.

Risk of an impoundment failure would be reduced because of additional design factors (see Geotechnical Engineering). Impacts to aquatics/fisheries in Rock Creek and the Clark Fork River from an impoundment failure could be significant in the short term and potentially significant in the long term depending on seasonal, locational, and operational variables.

Sediment. Under this alternative, several mitigations are proposed to reduce the quantity of sediment reaching reach Rock Creek. Eliminating ASARCO's proposed mine portal access road would minimize or eliminate slumping potential, in turn reducing sediment impacts to aquatic resources in Rock Creek. Overall impacts from bridge replacement and construction would be reduced (see Transportation). FDR No. 150's new location would be farther away from Rock Creek on a bench with more stable soils, minimizing impacts to the stream. Restricting the extent of road construction/reconstruction along Rock Creek would minimize the amount of unreclaimed and ungraveled surface subject to erosion.

Locating the tailings slurry line along FDR No. 150 could reduce associated disturbed acres. Reducing transportation and utility corridor construction should result in minor sediment-related impacts to Rock Creek under Alternative III.

BMP audits required for reclamation would help reduce sediment. In addition, a sediment source identification and mitigation program is proposed on NFS lands in Rock Creek and Bull River drainages equivalent to 130 acres of disturbed land under Alternative III. This program should reduce the existing sediment sources in the drainage as well as reducing the impacts of new sediment sources on Cabinet Gorge bull trout.

Even though sediment impacts cannot be quantified, it is clear that impacts would be less under this alternative. However, since very little spawning habitat is available, and available gravel in mainstem Rock Creek already contains a high level of fine sediment, any increase in deposited sediment in these spawning substrates would further reduce survival to emergence and potentially lead to elimination of fish populations. Any reduction in spawning success in Rock Creek could impact fish populations in Cabinet Gorge Reservoir. Therefore, impacts from sediment to Rock Creek would be potentially significant under Alternative III.

Water Temperature. Less disturbance would be required along utility and pipeline corridors, resulting in fewer impacts to the aquatic resources as a result of riparian zone disturbance. One detour bridge would not be required reducing the disturbance to streamside vegetation.

Stream Habitat Alteration. Modified road locations and timing of one bridge replacement would reduce direct stream habitat alterations. Streams at the mill site would be placed in constructed streams channels rather than concrete-lined ditches. This would reduce impacts to aquatic life in these streams.

Wilderness Lake Water Levels. Increasing the level of rock mechanic analysis and mine plan reviews to reduce the risk of subsidence would also reduce the risk that wilderness lakes would be affected by the mine. Therefore, impacts to wilderness lake water levels under Alternative III would be unlikely. If lake levels were reduced as a result of mining activities, a contingency plan would be implemented to curtail the flow to underground workings and to mitigate impacts to wetlands and aquatic life. If a reduction in wilderness lake water levels should occur under Alternative III the impact would be significant and possibly irreversible.

Aquatic Invertebrates

Under Alternative III, nutrient levels would remain the same as Alternative II. The potential for erosion and sedimentation and spills would be reduced by mitigations and modifications to the project. Impacts to aquatic invertebrates would be mitigated in the unnamed tributaries of the West Fork of Rock Creek through the use of constructed channels (see Waters of the U.S. and Wetlands).

Fish

Impacts to bull and westslope cutthroat trout would be reduced under this alternative by mitigation measures discussed above. Measures proposed to mitigate for potential water quality impacts would also benefit threatened, endangered, and sensitive species. Despite mitigation measures, impacts to these species would remain significant under Alternative III.

Alternative IV

Aquatic Habitat

Spill and Impoundment Failure. Moving the mill site to the confluence location would result in a shorter slurry pipeline and haul distance for trucks carrying mill reagents and ore. The headwaters of the West Fork of Rock Creek would no longer be at risk from a spill.

Sediment. This alternative should result in a substantial reduction of sediment reaching Rock Creek. The disturbed acreage would be smaller, and the length of the utility corridor shorter. In addition, a 300-foot buffer between the mill site and the East and West forks of Rock Creek would further reduce the quantity of sediment that actually reached Rock Creek.

This alternative requires the least amount of new road construction and reconstruction of any of the action alternatives. Since road construction is a major source of sediment, reducing the road construction should reduce sediment impacts to Rock Creek. Although an additional overpass bridge would be required, a new bypass road around the mill site near the West Fork of Rock Creek would not be required.

Stream Habitat Alteration. By moving the mill site to the confluence area, direct habitat impacts to the West Fork of Rock Creek and its unnamed tributaries would be reduced or eliminated.

Fish

Development in West Fork of Rock Creek would be limited to exploration activities. Since the upper reaches of West Fork of Rock Creek support apparently self-sustaining populations of resident bull and westslope cutthroat trout, it would be less detrimental to those fisheries resources to locate the mill site and mine portal downstream. Fish populations in the headwater portions of the West Fork of Rock Creek would remain relatively undisturbed.

Cumulative Impacts

Roads constructed for a timber sale in the drainage concurrent with mining could have an effect on the timing and magnitude of runoff events thereby increasing sediment. This would pose major and significant impacts under alternatives II and III. Cumulative impacts to aquatic/fisheries resources under alternatives II and III would be potentially significant. Under alternative IV, a drainage-wide sediment source reduction program would reduce the cumulative impacts.

BIODIVERSITY OF WILDLIFE HABITAT/VEGETATION AND WILDLIFE SPECIES (BIODIVERSITY)

Summary

The proposed project could have a significant effect on components of biodiversity under all action alternatives. The proposed project could result in a decline of local plant and animal species diversity and numbers. These are potentially long-term effects.

These potential effects could result from mine-related impacts such as: increases in human intrusion and disturbance; loss of habitat and/or a decline of habitat effectiveness; and/or increases in mortality risks. It would be the combination of indirect and cumulative impacts that would cause the more detrimental effects to most animal species.

The analysis of sensitive animal species is based on limited information. Additional studies are ongoing or would be started, with information being available for the final EIS. Potentially significant impacts could occur to four Forest Service sensitive species (harlequin duck, fisher, lynx, and wolverine) and/or their habitats, one management indicated species (pileated woodpecker), old growth habitat and old-growth-associated species. Three of these species are candidates for listing under the Endangered Species Act. Impacts could occur to mountain goats, a management indicator species. All these species would be affected to some degree by loss, alteration, and degradation of important habitat, increased noise levels, and increased human disturbance and activities (recreational and mine-related). There would be a potential loss of harlequin duck breeding leading to a decline and possible elimination of the lower Clark Fork subpopulation. Effects on threatened and endangered species are discussed in a separate section (see Threatened and Endangered Species).

Wildlife in general could be displaced, restricted in use of habitat and travel corridors, and suffer higher stress and mortality levels. A decline in certain animal and/or herd health could result.

The proposed project would affect habitat by physical alteration or destruction, fragmentation, and decreasing effectiveness or usability. Old growth ecosystems would be significantly reduced. The loss and degradation of old growth habitat, under all action alternatives, would add to the decline in abundance and occurrence of various old-growth-associated species in Compartment 711.

Up to 12 populations of plant species of special concern would be lost under the action alternatives which include up to three populations of crested shield-fern, a Forest Service sensitive species. Alternative IV would impact the fewest populations of plant species of special concern. A reduction of plant community diversity on reclaimed sites compared with similar undisturbed lands would result. In addition, the proposed project would result in an increased rate of noxious weed spread over current conditions.

Alternative I would have the least impact on biodiversity, including wildlife and vegetation resources. Alternatives II, III, and IV would likely have significant short- and long-term adverse impacts for many aspects of biodiversity.

Introduction

Aspects of biodiversity that are discussed in this section include plant species of special concern, noxious weeds, wildlife habitat/vegetation communities, old growth forests, and wildlife species including Forest Service sensitive wildlife species and management indicator species. Other sections that tie closely to this discussion are Wetlands and Waters of the U.S., and Threatened and Endangered Species.

Two discussions of old growth occur. Forest Service management of old growth as MA 13 is discussed in a separate section (see Forest Plan). The biological effects of the proposed project on existing old growth are discussed in this section.

Alternative I

Wildlife habitat and vegetation communities would continue to change due to logging activities, commercial and residential developments, fire, and natural succession. As a result, forest fragmentation would also increase as would noxious weeds. Old growth habitat on NFS lands, because it currently is designated under MA 13, would remain primarily undisturbed. Existing levels of effective old growth (7.0 percent) would remain below biologically sound amounts until other forest stands (replacement growth[1]) evolved into effective old growth habitat. **Table 4-25** displays potential acreage of old growth and replacement old growth affected by each alternative. Under current conditions, the long-term maintenance of old-growth-associated species would be difficult.

Impacts to plant species of special concern are difficult to predict. Site-specific activities are unknown and surveys are incomplete to date. There would be a minor amount of spreading of noxious weeds under Alternative I.

Wildlife would be affected to varying degrees by the expected changes in habitat and human activities. Human-caused wildlife disturbance and habitat impacts are expected to rise as human population and demands increase. The status of Forest Service sensitive species would be maintained until additional information is obtained or conditions changed. Habitat for the lynx, fisher, wolverine and old-growth-associated species would continue to degrade as forest fragmentation increased. Mortality

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[1] Replacement old growth contains some but not all old growth characteristics and is part of MA13 as managed by KNF.

TABLE 4-25.
Comparison of Alternative Effects on Old Growth Habitat in Compartment 711

Old Growth Component	Alternative			
	I	II	III	IV
OLD GROWTH (OG):				
Total Acres of OG Lost	0	208	154	91
destroyed ()	(0)	(64)	(54)	(34)
ineffective ()	(0)	(144)	(100)	(57)
Remaining OG Acreage	977	769	820	886
Percent Reduction from Current OG	0.0	21.0	15.8	9.3
Percent OG in Comp. 711	7.0	5.5	5.9	6.4
REPLACEMENT OLD GROWTH (ROG):				
Total Acres of ROG Lost	0	16	3	0
destroyed ()	(0)	(6)	([illegible])	(6)
ineffective ()	(0)	(10)	(0)	(0)
Remaining ROG Acreage	537	521	534	537
Percent Reduction from Current ROG	0.0	2.9	0.6	0.0
Percent ROG in Comp. 711	3.9	3.7	3.8	3.9

Source: OEA Research and Kootenai National Forest 1995.

risks likely would increase as human presence and use of the area increases. The occurrence of breeding harlequin ducks on Rock Creek likely would continue but would remain vulnerable. The stability of the lower Clark Fork subpopulation of harlequin ducks would remain tenuous due to low population, habitat threats, and mortality risks.

An increase of mountain goats in the Rock Creek area may be expected if goats are displaced by the Montanore project. Elk and other wildlife security could improve as open road densities are reduced to meet Forest Plan compliance. The downward trend of amphibian abundance and occurrence is expected to continue.

Alternative II

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative II, 12 of 18 populations of plant species of special concern (five different species) identified in the permit area would be eliminated. Construction of the tailings impoundment would destroy one population of both black snake-root and slender wintergreen and much of the relatively extensive yerba buena population. Construction and/or reconstruction of the roads, slurry pipeline and powerline corridor along Rock Creek would destroy the known populations of fringecup, pointed broom sedge, and crested shield-fern (a Forest Service sensitive plant species), and one population of black snake-root. Suitable habitat for all five species would also be lost or affected. Crested shield-fern populations occur in Waters of the U.S. and wetlands. More information is needed about the distribution of each species, in particular, crested shield-fern, to determine long-term impacts to species viability. A conservation assessment for the crested shield-fern would be prepared for the final EIS. This assessment would evaluate the impact of removing the local plant populations affected by the project on the extended population.

Noxious Weeds. The disturbed soil created by construction activities would provide favorable sites for spotted knapweed, St. Johnswort, and Canada thistle. The spread of weeds is unavoidable. Noxious weed seed would likely be spread by vehicles moving from infested areas to newly disturbed areas and along roads and utility corridors. Potential introduction and spread of weeds from the exploration adit site and increased traffic on Chicago Peak Road increases the likelihood of weed introduction into the CMW. ASARCO has committed to developing an effective weed management plan in cooperation with the Sanders County Weed Board, and the Agencies (ASARCO, Incorporated 1987 - 1994). Implementation of the revegetation plan and early detection of new infestations and treatment would be key elements of ASARCO's weed monitoring and control program. Any necessary herbicide applications would be made in accordance with approved materials and methods under the supervision of licensed applicators as required by law. An effective weed control program would minimize weed infestation on lands disturbed by mining and road building.

Wildlife Habitat/Vegetative Communities. Direct impacts from the proposed project would occur to wildlife habitat. Wildlife habitat would be negatively impacted primarily in three ways: 1) by physical alteration, 2) by land rendered ineffective or less usable, and 3) by fragmentation. New habitat for species that prefer openings would be created.

A total of 584 acres of wildlife habitat would be degraded, lost or altered due to the proposed project. About 293 acres of forested habitat, 273 acres of riparian habitat, 8 acres of wetlands, and 10 acres of subalpine habitat would be lost under Alternative II. Impacts to water resources, such as Rock Creek, West Fork of Rock Creek, and wilderness lakes, are described in Aquatics/Fisheries and Hydrology. Habitat that is altered or destroyed can have a short- or long-term effect. The importance of habitat loss is variable depending on individual species and circumstances. The importance of habitat loss is further discussed in relation to particular species. Habitat loss due to mine-related home building and recreational demands would also occur.

Secondly, some wildlife habitat would be rendered ineffective or less usable. The proposed project would create a zone of disturbance caused by mine-related noises and activities, increased road traffic, and increased human presence, within which habitat would be unusable or less fit for certain animals. The affected acreage would vary depending on the different tolerances and adaptabilites of specific wildlife species (a few acres to thousands of acres) and due to different types an durations of disturbances. For example, the zone of unusable habitat would be smaller for mule deer than elk because mule deer are considered to be more tolerant of noise. The greatest amount of habitat rendered ineffective or less usable would occur during the construction of the mine, when the loudest noise levels are anticipated. A slightly less amount of habitat would be rendered ineffective or less usable during operation of the mine. For example, disturbances caused by blasting would likely take place within the first several years of the project. Disturbances caused by traffic would occur throughout mine life. Ineffective or less effective habitat would likely return to usable habitat upon closure of the mine and completion of reclamation.

The third direct impact to wildlife habitat would be increased fragmentation. Usable habitat would be fragmented by construction of mine facilities, thus changing its nature and making it less ineffective for some species. Habitat may be bisected by more and/or wider roads, for instance, or isolated from other similar habitat. The proposed project would fragment old growth and riparian habitat, travel corridors, and other important habitat or habitat components. Approximately 8 miles of new road would be built. The significance of fragmentation from road building is variable depending on wildlife species or ecological community. However, in general, increased fragmentation would be undesirable for key wildlife and biological (such as interior bird species and fishers) communities on KNF. The level of fragmentation would increase.

The proposed project would eliminate forested cover along the utility corridors. This change from forested to open grass/shrub communities would provide additional habitat for those species preferring open areas (such as juncos and bluebirds). This has minor benefits as this type of open habitat is not limited on the KNF. Forested habitat would be reduced.

The revegetation plan proposed by ASARCO would result in extensive areas seeded to grass and forb cover during the life of the operation. These areas would likely be attractive foraging areas for some species such as big game and bear.

Overall plant community diversity would be lost in the short term and succession would be slow due to changes in soil materials and revegetation (see Soils and Reclamation). Importance of effects on wildlife habitat would be variable depending on species and circumstances.

Old Growth Habitat. Potential impacts to effective old growth habitat would be: a loss of acreage, an increase in habitat fragmentation, and a reduction in habitat effectiveness and dispersal corridors. This could result in a population decrease of old-growth-associated species and a decline in biodiversity in the Rock Creek area. This would add to the unlikelihood of long-term occurrence and maintenance of old-growth-associated species in Compartment 711.

Alternative II would result in an effective loss of an estimated 208 acres of old growth habitat, which is a 21 percent reduction in Compartment 711 (see **Table 4-25**). Effectiveness of the remaining old growth would decrease due to increased fragmentation and edge effect. Effectiveness of travel and dispersal corridors along Rock Creek and the West Fork of Rock Creek would be severely reduced due to the presence of the mine facility and roads. Four old growth stands would be directly impacted. Two of these, currently providing the largest blocks of old growth, would be reduced in size. Habitat known to contain a nesting territory of pileated woodpeckers and frequently used by goshawks would be eliminated or have its effectiveness reduced. The percentage of old growth habitat in Compartment 711 would decline to 5.5 percent, well below the recommended 8 to 10 percent needed to support old-growth-dependent species. Loss of degradation of old growth habitat, as a result of Alternative II, would add to the decline of occurrence, abundance, and diversity of old-growth-associated species in Compartment 711. Ramifications of this on a large scale (e.g., Cabinet Mountain ecosystem) cannot be determined without additional information and analysis. There could be a short-term and possibly long-term loss of species diversity.

Impacts to effective old growth habitat under Alternative II would be significant.

Wildlife Species

General Impacts to Wildlife. Impacts from the proposed project would occur to wildlife individuals or populations. The proposed project would negatively impact wildlife in four primary ways: 1) by displacement; 2) by restriction in use of habitat and travel corridors; 3) by increased disturbance and mortality; and 4) by impacts to habitat, as previously described. The combination of indirect and cumulative effects likely would have greater impacts than direct effects.

The proposed project would displace some wildlife into other areas for various lengths of time. Mine-related noises and activities, increased road traffic, and increased human presence would cause some wildlife to leave the area. Some wildlife would return after mine-associated disturbances ceased and some would not. Displaced animals could suffer reduced vigor due to the stress associated with being displaced. Decreased vigor could also occur if the animals were displaced into less suitable habitat. Where suitable replacement habitat was not available, eventual mortality could occur.

The proposed project would also restrict movement of some wildlife. Rock Creek is a travel corridor for numerous species, including deer and elk. The mill site, increased road widths, new roads and utility corridors and increased traffic levels would decrease effectiveness of Rock Creek drainage as a travel corridor and could inhibit movement.

The proposed project would result in a higher occurrence of wildlife-vehicular collisions and resulting deaths. Under the proposed project, FDR No. 150 would be paved and upgraded. Traffic would increase about 1,440 percent on FDR No. 150 and 38 percent on Montana Highway 200 (see Transportation).

Several key indirect impacts to wildlife would occur. Increased hunting pressure, poaching and disturbance to wildlife would result from the increased access and human population associated with the proposed project. More hunters and recreationists would be able to access areas currently difficult to reach because FDR No. 150 would be upgraded and maintained for year-round use (see Recreation). As a result, more human activity, would occur during all seasons. This human-caused disturbance could have numerous detrimental effects on wildlife, including a decrease in health and vitality, a decrease in reproduction potential, and an increase in stress levels. Wintering animals would be especially sensitive to increased human access and presence.

The overall increase in human activity would increase poaching potential; the amount of any illegal taking of wildlife is difficult to determine and predict. Recent mine-related poaching occurrences in Libby provide some insight into potential problems. In 1990, a total of 14 separate charges were brought against five subcontractors of Noranda Mineral Company for poaching 11 big game animals on the Montanore project site (Bratkovich 1992). While measures would be taken to reduce poaching potential, some poaching would inevitably occur. In general, greater wildlife mortality could result from increased hunting pressure, poaching, and from a decline in habitat quality and animal health.

General impacts to wildlife species under Alternative II could be significant for some species.

Forest Service Sensitive Wildlife Species. The following worst-case analysis on sensitive species is based on limited available habitat and species population information. Between release of the draft EIS and final EIS more information would be available because of ongoing or planned studies that would allow a more informed discussion about the impacts from the proposed project. The Montana Natural Heritage Program is preparing a region-wide conservation assessment on the harlequin duck. This assessment will analyze species viability. Management and monitoring strategies will be developed to conserve the species.

A habitat-based assessment, using satellite imagery, is planned for the fisher, lynx and wolverine. The intent of this study is to more accurately delineate actual and potential habitat. From the study the Agencies would be able to more accurately determine the effects of the project on these species. The analyses display the greatest amount of impacts possible (worst-case analysis).

Four sensitive species -- harlequin duck, lynx, wolverine, and fisher -- could be affected by the proposed project. Of these four, the harlequin duck would be the most directly affected. Loss and degradation of effective habitat, increased human disturbance, and increased mortality risks would occur, that could lead to abandonment of traditional ranges, a decline in local species occurrence and abundance. Two other sensitive species, the Townsend's big-eared bat and black-backed woodpecker, could be slightly affected, although levels of impact would likely be minor and would not cause any long-term effects. Two other sensitive species, the Coeur d'Alene salamander and northern bog lemming, would not be affected. Potential to create wintering habitat for the Townsend's big-eared bat could occur upon closure of the mine and retrofitting adits to accommodate bats. Potential effects on the boreal and flammulated owls could not be determined at this time.

Forest Service sensitive species generally would be affected by the proposed project in a similar manner as previously described in General Impacts to Wildlife. A discussion on individual sensitive species follows.

- **Harlequin Duck.** The ultimate effects of the proposed project on harlequin ducks likely could result in a long-term (possibly permanent) loss of harlequins in Rock Creek and one of the remaining 25 to 30 harlequin breeding areas in Montana. This would be significant to local harlequin populations as one of four breeding areas would decline or be eliminated for the lower Clark Fork subpopulation. Loss of this subpopulation could result in weakening the status of harlequins in Montana.

  Harlequin ducks, especially breeding females, avoid areas frequented by humans and/or human activities (Reel, Schassberger, and Ruediger 1989). Increased mine-related noise levels and activity, such as the 1,440 percent increase of traffic along the adjacent FDR No. 150, and invariable increase of human use on Rock Creek likely would create intolerable levels of disturbance for the harlequin duck. Additionally, some harlequin habitat near or in the riparian zone could be altered or destroyed. Short-term reduction of water quality would occur during construction. Should this affect aquatic insect populations (see Aquatics/Fisheries), the main food base for harlequins could be reduced for short durations.

Harlequin ducks and their offspring may attempt to return to Rock Creek for several years after the proposed project was initiated. Their attempts to successfully breed and raise their young likely could be thwarted due to mine-related activity and could result in harlequin ducks abandoning Rock Creek as a breeding area or could result in harlequins returning and unsuccessfully breeding year after year. The ducks probably would not successfully relocate or be displaced to adjacent streams because of their strong fidelity to traditional areas. Whether the ducks abandoned Rock Creek or remained and bred unsuccessfully, the result would be the loss of harlequin duck reproduction.

Loss of one of the four breeding areas and the associated decline in recruitment of harlequin ducks could be significant to the lower Clark Fork subpopulation. This would result in the decline and possible elimination of this subpopulation. Should loss of the lower Clark Fork subpopulation occur, stability of the Montana harlequin duck population would decline (J. Riedel, pers. comm., March 20, 1995).

Disturbance and the subsequent loss of some effective harlequin habitat along Rock Creek would last for 35 years (from mine construction through operation and reclamation). While effective harlequin habitat may occur after mine-related disturbances end, harlequins probably would not return to or recolonize Rock Creek. This is because the knowledge of Rock Creek as a breeding area would end with the last successful brood of harlequins raised in Rock Creek and colonization of unoccupied streams is likely a rare event (Reichel and Genter 1995).

Impacts to harlequin ducks under Alternative II could be significant.

- **Fisher.** The proposed project would result in a loss of some critical fisher habitat and would increase mortality risks. This could result in a decline of population number.

  The proposed project would result in a loss of fisher habitat through physical destruction, fragmentation, and a decrease in effectiveness. Loss and degradation of key habitat components for fishers: old growth forests, riparian areas, and travel corridors would occur. Critical habitat reduction would occur for both the short and long terms. Existing old growth would be reduced by 21 percent. Some riparian habitat in the drainage would be effectively lost.

Rock Creek would likely become a less effective or an ineffective travel corridor, thereby reducing movement between Rock Creek drainage and CMW. Reducing fisher movement between drainages is undesirable (Heinemeyer and Jones 1994) and counter-productive to recovery efforts in the Cabinet Mountains.

The proposed project might increase mortality potential due to slightly increased direct or incidental trapping anticipated related to anticipated mine-related increased local human population (see Recreation). This impact could be worsened by the increased year-round access. Successful reintroduction of fishers in the Cabinet Mountains may be limited by incidental trapping (Heinemeyer and Jones 1994). Mortality risks also would increase due to greater traffic volumes and potential for vehicle-caused fisher deaths. Because the fisher population is small and fisher habitat limited, loss of individuals or critical habitat could be significant.

While fishers have demonstrated tolerance to moderate degrees of human activity (Heinemeyer and Jones 1994), the proposed project would cause high levels of human activity. As a result, fishers could be displaced out of Rock Creek drainage and/or suffer high stress levels. At least one of the remaining radio-fitted fishers uses the proposed project area as part of her homerange. At a minimum, the proposed project would likely displace this female in all or part of her homerange and may disrupt reproduction success.

Should fishers successfully relocate elsewhere during mine life, they may not re-establish in Rock Creek drainage after mine closure due to reduced habitat quality and expected low fisher population numbers. Disturbance would substantially decrease after mine closure, but habitat loss, primarily old growth, would remain.

The proposed project would eliminate and degrade critical fisher habitat such as old growth, increase human disturbance, and increase mortality risks.

Impacts to the fisher under Alternative II could be potentially significant.

- **Lynx.** The proposed project would result in loss or degradation of lynx habitat through physical destruction, habitat fragmentation, and habitat rendered ineffective. Portions of Rock Creek drainage and surrounding areas would become a less or an unsuitable place for lynx. Mortality risks would increase due to increased human use and accessibility to habitat. Mortality from additional trapping or poaching likely would be low. However, because lynx are highly susceptible to trapping and populations are very low, loss of individuals could be significant. After mine closure disturbance would substantially decrease. Some habitat would become available again and some would remain lost or ineffective. Trapping and mortality risks would decrease but could remain higher than pre-mine levels.

The proposed project would add to the overall decline of lynx security and habitat on the KNF. The effects of the proposed project on lynx populations in the Cabinet Mountains is discussed in context of cumulative effects (found at the end of Biodiversity). Impacts to the lynx under Alternative II could be potentially significant.

- **Wolverine.** The proposed project would result in loss or degradation of wolverine habitat through physical destruction, habitat fragmentation, and habitat rendered ineffective. Other mortality risks and incidental trapping would increase due to increased human use and accessibility to habitat. Wolverines currently occurring in Rock Creek could be displaced out of Rock Creek drainage during the 35-year mining period. The project-related habitat loss and increased mortality risk could result in a decline of wolverine numbers and security in the Cabinet Mountains. After mine closure, wolverines could return to Rock Creek drainage. Disturbance would substantially decrease from mine operation levels. Some habitat would remain lost and some would become available but overall, habitat would remain of a lower quality.

  The proposed project would add to the overall decline of wolverine security and habitat on the KNF. The effects of the proposed project on wolverine populations in the Cabinet Mountains is discussed in context of cumulative effects (found at the end of Biodiversity).

  Impacts to the wolverine under Alternative II could be potentially significant.

- **Townsend's Big-eared Bat.** The proposed project would destroy 583 acres of potential summer roosting and foraging habitat. Additional similar habitat is present in the area making this loss of habitat less than significant. Winter habitat is not expected to be affected. It is not known how mine-related disturbance, such as noise, smell and lights, would affect bats. Should these disturbances be undesirable to bats, a larger amount of habitat could become less effective or ineffective habitat. This could cause bats to abandon the portions of Rock Creek drainage. Because bat winter habitat would not be affected and loss of summer habitat is considered minimal, the proposed project would not be expected to result in the decline of local bat populations.

- **Northern Bog Lemming.** The proposed project would not likely affect the lemming or its habitat. Bog lemming habitat occurs in the East Fork of Rock Creek drainage and would not be affected by the proposed project. There would be little increased mortality risk to the obscure bog-dwelling lemming.

- **Black-backed Woodpecker.** The proposed project would not likely affect the preferred habitat of the black-backed woodpecker. However, 21 percent of existing of old growth forests in the drainage, which is part of their habitat would be lost as effective habitat. The dynamic forces that create preferred black-backed woodpecker habitat, fires and bug infestations, could occur at any moment, thereby changing the status of existing habitat and woodpecker populations. Under current conditions the proposed project would result in some habitat loss, but would not adversely affect the woodpecker.

- **Coeur d'Alene Salamander.** The Coeur d'Alene salamander or its habitat would not be affected by the proposed project. The one known area in Rock Creek that provides suitable habitat, a splash zone adjacent to Rock Creek, would not be affected by mine-related activities.

Forest Service Management Indicator Species. Four of the eight management indicator species (mountain goat, white-tailed deer, elk, and pileated woodpecker) are discussed below; the others are discussed under Threatened and Endangered Species. The four management indicator species would be affected by the proposed project in a similar manner as that previously described in General Impacts to Wildlife. Specifics to indicator species are presented here. Proposed project could have major impacts to mountain goats and pileated woodpeckers. As indicators of old growth/snag or cavity habitat and alpine habitat, respectively, the affects on these species could be used to gauge effects on those habitats.

- **Mountain Goats.** The overall effect of the proposed project could be a decline in health and numbers of the Rock Peak goat herd. Goats likely would suffer prolonged, increased stress levels during construction and operation, that could result in a decline in vigor, and reproduction rates. Because mountain goats have a relatively low reproduction rate and because the Rock Peak herd is thought to be unstable, any increased mortality could have negative short- and long-term impacts on the goat population. The proposed project would result in some goat habitat becoming undesirable and/or less effective, and less productive during mine life and reclamation.

  The indirect effects of the proposed project are discussed first, as these in many instances, have greater impacts than direct effects. Key indirect effects would be disturbance and displacement. Both of these result in goat stress, potentially leading to a decline in health of individual goats and the herd.

  The proposed project would result in a general exposure of the area to more disturbances due to increased recreation, hunting and poaching. Increased disturbances (such as human noise from recreationists, snowmobiles and general human presence) are associated with the expected mine-related increase of local human populations and use of area. Disturbance would be facilitated by the proposed improved roading and year-round access. While often underrated, these indirect effects, which would extend beyond Rock Creek drainage, can have great impact on goat populations (Geist 1975; Joslin 1980; Joslin 1986; Rice and Benson 1984).

  The proposed project also would result in some goat habitat becoming undesirable and less effective during construction, operation, and reclamation of the mine. This is because mine-related activities would cause noises, smells, and other indications of human presence in the surrounding area, creating unfavorable conditions for goats. Goats reacting to these conditions would likely either leave the area (be displaced) or remain and tolerate the adverse conditions. Either response would increase stress levels. Increased stress levels could result in a decline in health, vigor, and reproduction rates and could ultimately result in death. Other mortality risks would also increase. Poaching and legal harvest of goats would probably increase with the greater human accessibility and use of the area. In other goat herds, this has resulted in a marked decline or elimination of goat herds (Foster 1987; Joslin 1986; Phelps, Jamieson and Demarchi 1975). Goats that could be disturbed and thus affected by stress range on east and west sides of the Cabinet Range including Rock, Ramsey, West Fisher, and Libby creeks and nearby peaks and ridges. Goats using their core winter range near Rock Creek Meadows would be especially vulnerable to disturbance and mortality.

The displacement of goats from the disturbed habitat likely would take several years to occur, beginning at time of construction. Displaced goats would probably remain so for the duration of the mine operation. It is not known if suitable habitat exists to accommodate displaced goats.

After mine closure, recolonization of habitat from which the goats were displaced likely would take a long time and the potential exists that displaced goats may not return. Displacing goats from traditional habitat for a 30-to-35-year duration could result in habitat use information not being passed on to new generations. The long-term effects of displacement could be the loss of goat herd occurrence or abundance in Rock Creek, Copper Lake Basin, and adjacent areas for greater than 35 years.

The area from which goats would probably be displaced includes the habitat adjacent to the proposed project that, for reasons described previously, would become undesirable, less effective, and/or less productive. The amount of area or habitat effected is variable depending on the type and duration of disturbance. For instance, the loudest and most far-reaching noises would occur during construction. Noise associated with the wilderness adit would begin somewhere around year 15 of mine operation. Impacts associated with the mill site and FDR No. 150 would occur during mine life. A rough estimate would be that habitat falling within 1 to 2 miles of the proposed project would diminish in value.

Specifically, mine-related presence and noise activities would cause approximately 8,492 acres of goat habitat to become less desirable, less effective, or unusable to the goats at various times and durations over project life. (These areas may appear physically unaffected to humans.) Approximately 1,892 acres of mountain goat Situation 1 habitat (high-quality summer or transitory habitat used by goats) would be affected. Of these acres, 450 would be affected due to the wilderness ventilation adit and 1,442 would be affected due to the mill site. An additional 6,600 acres of mountain goat Situation 3 habitat would also be affected, some of which are already affected by existing roads and uses. Additionally, possible travel corridors leading to Government Mountain would be blocked by the mill site.

Direct habitat alteration or removal caused by the proposed project would be minor. Eight acres of mountain goat Situation 1 summer/transitory habitat would be lost. This includes less than 1 acre at the wilderness ventilation adit and about 7 acres at the exploration adit site. Development of the mill site and transportation/facilities corridor would result in the destruction or alteration of about 14 acres of mountain goat Situation 3 habitat.

Effects on some key habitat components, kidding areas and licks, could not be determined.

The proposed project could affect mountain goats and the Rock Peak goat herd by increasing levels of disturbance, stress, and mortality risks. The proposed project would eliminate or render habitat less effective. The ultimate effect could be a decline in goat numbers and loss of goat occurrence or abundance in some areas. These effects are magnified when cumulative effects are considered (see Cumulative Impacts).

- **Elk.** The proposed project would result in some elk habitat loss through physical alteration and a decrease in effectiveness.

  The main elk winter range, the Green Mountain/McKay Creek range, probably would not be directly affected by the proposed project. However, several small bull elk wintering areas; located near the tailings impoundment, between Miller and Rock Creek, and in scattered areas along Rock Creek, would be rendered less effective habitat due to mine-related disturbances. Some potential elk summer habitat would be made less effective due to increased open road densities, from 0.96 to 1.10 open miles per road square miles of land in Compartment 711 plus some portions in McKay Creek (essentially, the area defined by BAAs 761 and 752). The resulting density would be at a level higher than biologically recommended (Thomas 1979).

  The proposed project would increase elk mortality risk due to increased traffic and human access and use. Poaching frequency and hunting likely would rise.

  Some elk could be displaced out of the vicinity for 35 years. In general, elk use of the Rock Creek area could decline for the life of the mine.

- **White-tailed deer.** Direct effects as a result of the proposed project would include physical loss of habitat, displacement, and loss of individuals from the population. The proposed project would increase mortality risk from increased traffic, human use and access, and poaching. The anticipated increases in mortality and habitat loss would not affect white-tailed populations.

- **Pileated Woodpecker.** The proposed project would affect the pileated woodpecker by eliminating or degrading key habitat (old growth) including occupied nesting territories. Approximately 21 percent of existing old growth in the drainage would be lost as effective habitat (see Old Growth). The percentage of old growth in the compartment would decline to 5.5 percent, well below the recommended 8 to 10 percent needed to support pileated woodpeckers. Suitable nesting habitat would be very limited. Due to small stand size, lower habitat quality, and limited quantity, the remaining old growth habitat may not provide the needs to sustain local populations of the pileated woodpecker in the long term.

Impacts to the pileated woodpecker under Alternative II would be potentially significant.

Other Species of Interest. Other species of interest could be affected by the proposed project in a manner similar to that described under General Impacts to Wildlife. Effects to some species are described below.

- **Black Bears.** Black bears would be directly affected by the proposed project by physical loss of habitat, disturbance, and an increase in mortality potential. The building and operation of the proposed project would alter or destroy 583 acres of black bear habitat. An additional 7,909 acres would be rendered less effective habitat. Habitat lost or rendered ineffective includes key areas such as riparian areas and travel corridors.

  Black bears likely would be disturbed and could be displaced. The number of bears potentially affected by the proposed project is difficult to determine. However, 5 female radio-collared black bears use the proposed project area as part of their homerange (Kasworm and Manley 1988) and could be impacted and displaced. Other bears also could be impacted and displaced.

  The proposed project would increase mortality risk from increased traffic, human use and access, hunting, and poaching.

Mule Deer. The proposed project would cause a general loss of mule deer habitat. Critical habitat such as winter ranges would not be affected.

Moose. Moose habitat loss would most prominently occur in the slurry pipeline and road corridor along Rock Creek. Noise and activity disturbance could displace moose out of the area. It is unknown how this could affect the local population.

Mountain Lion. Fluctuations in big game populations affect mountain lions more than habitat loss because of their dependence on a prey base such as deer. The proposed project could cause a displacement of some local big game populations and a related mountain lion displacement. If deer are displaced into areas occupied by humans (such as housing development) or if mine-related home building occurred in areas with concentrations of big game, an increase in human-lion encounters could occur. Mortality risks to mountain lions could result from increased potential for vehicle-lion collisions and increased hunting. Increased mortality is not expected to affect mountain lion populations.

Important Wildlife Groups.

- **Furbearers and Small Mammals.** Furbearers and small mammals would be affected similar to impacts described under General Impacts to Wildlife and other sections such as Forest Service Sensitive Wildlife Species. Impacts to furbearers and small mammals under Alternative II are variable depending on species.

- **Birds.** A variety of songbirds and neotropical migrants would be affected by habitat loss and mortality. The proposed project would eliminate 292 acres of coniferous forests and could affect an estimated 273 acres of riparian habitat, the habitats where the greatest diversity of bird species occurs. Those species associated with old growth would be affected the most. Fragmentation of forested habitats and the increase in open grass-shrub habitats would result in higher populations of those birds preferring open habitats and loss of individuals preferring forested environments. Loss of individual birds, both juveniles and adults, could be expected during construction of the mine, depending on season and specific location of disturbance. The indirect effect of building mine-related housing would be to eliminate bird habitat.

  Raptors would experience a loss of habitat. Those raptors associated with specialized habitat, such as old growth and riparian zones, would be negatively affected (see Old Growth). Potential for raptor mortality by powerline electrocution would be minimized by proposed raptor-proofing (ASARCO, Incorporated 1987-1994).

  Two of the four game species found by Farmer and Heath (1987) would be affected by the project. The ruffed grouse and blue grouse would suffer habitat loss and increased mortality. Some ruffed grouse habitat would be eliminated during construction of slurry lines and road widening. Hunting pressure of grouse could increase, resulting in a higher mortality.

  Amphibians and Reptiles. An estimated ten species of amphibians and eight reptile species would be affected by habitat loss and direct mortality. The removal or fragmentation of wetland and riparian habitat (see Waters of the U.S. and Wetlands) would result in the loss of habitat for some species and in death of some individuals. The duration, magnitude, and level of significance of potential impacts to reptiles and amphibians could not be determined.

Alternative III

Impacts to biodiversity under Alternative III would be similar to Alternative II with the following exceptions.

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative III, 12 of 18 plant populations identified in the permit area would be eliminated. Construction of the tailings impoundment, roads, and slurry pipeline and powerline corridor along Rock Creek would destroy the same populations described under Alternative II. In addition, the construction of FDR No. 1022 Tye would likely destroy one population of black snake-root. It is likely that two populations of crested shield-fern would be lost.

On-site verification studies would be performed to precisely locate rare plant populations. This would be done concurrent with preliminary designs to avoid populations and habitat as much as practicable. In addition, ASARCO would conduct or fund a forest-wide conservation assessment for crested shield-fern to determine the impact of this loss on the regional population.

KNF would develop mitigation requirements in the Biological Evaluation being prepared for the project.

Noxious Weeds. Under Alternative III, fewer acres would be disturbed and revegetation efforts would be improved so that the likelihood of the establishment and spread of weeds would be reduced in many areas. However, the area of disturbance and traffic levels, especially on FDR No. 2741 would be similar to Alternative II, would still increase chances of weed introduction into the CMW.

Wildlife Habitat/Vegetative Communities. Less riparian habitat would be physically lost because slurry pipelines would remain on the east side of Rock Creek until the crossing of FDR No. 150 near Engle Creek. A similar amount of riparian habitat would be rendered ineffective due to noise and activity.

Since the utility and transportation corridors would be combined under Alternative III, less fragmentation of wildlife habitat would occur than under Alternative II, but the effects of fragmentation would remain the same.

The revegetation plan would be revised to meet Agency goals for reclamation success, wildlife habitat, and scenic resources (see Chapter 4, Soils and Reclamation and **Appendix H**). The plan would include the following elements that relate to wildlife concerns:

- low-palatable grass and forb species;
- appropriate palatability grass, forbs, and shrubs for minimal seed and planting mixes to replace wildlife forage and browse;
- planting plan that more closely resembles surrounding landscape and considers adjacent communities and wildlife travel corridors;
- using guidelines developed by KNF for native species planting;
- tree and shrub species selection that considers plant community successional relationships typical of the area.

These changes to the revegetation plan would result in less acreage being in grass and forb cover during the operation of the mine. In turn, considerably less acreage would be highly attractive to some species (e.g., big game and bear). Community diversity and successional relationships would be more closely maintained since a wider variety of trees and shrubs would be planted and native grass and forbs would be seeded. Plant succession would begin earlier. Some habitat elements (e.g., open vs. closed canopy, multilayered structure) would be maintained so displacement of some species (as a result of specific habitat element losses) would be reduced.

Effective Old Growth Habitat. Alternative III would result in a loss of an estimated 154 acres of effective old growth habitat, a 15.8 percent reduction of this habitat in Compartment 711. The percentage of effective old growth would decline to 5.9 percent, still below the recommended 8 to 10 percent needed to support old-growth-dependent species. While less old growth would be degraded under Alternative III, the same type of effects would occur as described under Alternative II. Impacts to effective old growth habitat under Alternative III would be significant.

Wildlife Species

General Impacts to Wildlife. Noise impacts from the wilderness adit would be reduced (see Sound). This would result in less alpine habitat disturbance than Alternative II.

Animal-vehicle collisions could be reduced by some unknown amount by eliminating the use of road salt and by daily removal of road-killed animals (thus removing scavenging opportunities).

Impacts to wildlife species under Alternative III would be potentially significant for some species.

Forest Service Sensitive Wildlife Species.

- **Townsend's Big-Eared Bat.** Potential to provide new bat winter and denning habitat exists upon closure of the mine. The exploration adit could be retrofitted by ASARCO to provide bat habitat while being safely closed to the public. No mitigation is currently proposed. The Agencies would evaluate the need for such mitigation prior to mine closure.

Forest Service Management Indicator Species.

- **Mountain Goats.** Reducing fan noise of the ventilation adit in the wilderness would reduce the amount of goat Situation 1 habitat rendered ineffective by approximately 450 acres. Additionally, the proposed closure of 2.5 miles of FDR No. 2741 would decrease some disturbances and mortality risks to some goats. These mitigation measures would reduce but not eliminate impacts on goats.

- **Pileated Woodpecker.** While less old growth habitat would be lost, the impacts to pileated woodpeckers under Alternative III would remain potentially significant.

Alternative IV

Impacts to biodiversity under Alternative IV would be the same as under Alternative III with the following exceptions.

Wildlife Habitat/Vegetation

Plant Species of Special Concern. Under Alternative IV, 11 of 18 plant populations identified in the permit area would be lost. Construction of the tailings impoundment, roads, and slurry pipeline and powerline corridor along Rock Creek would eliminate the same populations described under Alternative III with the exception that only one population of crested shield-fern would be lost. Construction of the alternate mill site would destroy one population of slender wintergreen and may destroy part of the pointed broom sedge population.

Noxious Weeds. Under Alternative IV, the mill site relocation would result in 517.5 acres of disturbance, somewhat reducing the spread of noxious weeds. Since mine-related traffic on FDR No. 2741 would be limited to exploration and occasional inspection under Alternative IV, the potential spread of noxious weeds would be reduced.

Wildlife Habitat/Vegetative Communities. The alternative mill site would shift some mill site-related effects (such as habitat loss and noise) from the upper West Fork of Rock Creek to an area near the confluence of the East and West forks of Rock Creek. Impacts to habitat in the West Fork area would be reduced but not eliminated because of exploration activities. Noise disturbances to the East Fork of Rock Creek could increase, resulting in effective loss of habitat and wildlife disturbance.

Effective Old Growth Habitat. Alternative IV would result in an effective loss of 91 acres of old growth habitat, a 9.3 percent reduction in compartment 711. The percentage of old growth habitat in Rock Creek Compartment would decline to 6.4 percent, below the recommended 8 to 10 percent needed to support old-growth-dependent species.

Impacts to effective old growth habitat under Alternative IV would be significant.

Wildlife Species

Forest Service Management Indicator Species.

- **Mountain Goats.** The alternative mill site would be closer to key goat winter range located in the East Fork of Rock Creek. Some mine-related noise disturbances such as blasting could impact goats on this winter range. This potential for mining noise disturbance would occur primarily during the construction phase of the mine.

Cumulative Impacts

Determining effects of the proposed project on biodiversity entails considering the immediate area for potential impacts (in this case the project area and Rock Creek drainage) and a larger area, the Cabinet Mountains ecosystem, of which Rock Creek drainage is an integral part. It is necessary to evaluate what is going on elsewhere in the ecosystem to more fully understand the effects of the proposed project on biodiversity.

When examining "the big picture", it is the cumulative effects of past, present, and future projects that often cause the most effects on many wildlife species in the Cabinet Mountain ecosystem. The proposed project, the permitted Montanore mine, past and future logging, roading, commercial and residential building, and increased human disturbance and presence, all incrementally contribute or have contributed to the degradation and fragmentation of habitat and increased mortality threats to animals. Especially at risk are animals such as lynx, wolverine, fisher, and rare or limited habitat such as old growth. Individually, a project or an activity may not pose serious threats, however, cumulatively, projects and activities could and do.

The potential impacts of the mine would intensify when considering the cumulative effects of the construction and operation of two large scale mines, one on either side of the CMW. Habitat would be lost or degraded. Animals would be stressed and/or displaced. Increase human use and human-caused disturbance would occur. Mortality risks would increase. Unoccupied habitat may not be available to accommodate dispersing animals for the duration of both mining projects.

Additionally, the presence of two mines in the Libby-Ramsey-Rock Creek corridor essentially could constrict and limit movement of wildlife between the southern and northern portions of the Cabinet Mountains. Should this occur, the ecosystem could be significantly fragmented.

These cumulative impacts are pertinent to many wildlife species and habitats. Some of the more notable subjects (mountain goats, fisher, lynx, wolverine and old growth) are specifically discussed.

Part of the Rock Peak mountain goat herd uses the head of Libby and Ramsey creeks during the summer and winters in Rock Creek Meadows. They also use habitat between these locations. Thirty-five years of activities, disturbance and stress caused, at times, by two mines could result in loss of individual goats and/or result in a decline of herd abundance, health and occurrence in some traditional ranges.

For far-ranging sensitive animals, such as lynx, wolverine, and fisher, the proposed project would add to the cumulative habitat degradation, ecosystem fragmentation, and mortality risks that threaten the security and/or recovery of these species in the Cabinet Mountains. The cumulative effects could be significant. Determination of the effects on species viability can not be determined at this time with information currently available.

The cumulative effects on old growth and old-growth-associated species are difficult to determine without additional analysis of lands throughout the Cabinet Mountains. The proposed project (or its action alternatives) would degrade or eliminate 91 to 208 acres of old growth. The Montanore project is estimated to disturbed approximately 192 acres of protected old growth (MA 13) (U.S. Forest Service et al. 1992). Because the occurrence of old growth habitat is considered to be limited and declining, and is an important habitat component for several sensitive species, the cumulative loss of old growth habitat would be significant.

Cumulative impacts under all action alternatives would be similar. Cumulative impacts to biodiversity under all action alternative would be potentially significant.

THREATENED AND ENDANGERED SPECIES

Summary

Increased vehicle traffic would result in more road-killed animals, thereby increasing the potential for bald eagle mortality due to vehicle collisions with scavenging birds. Impacts to bald eagles under Alternative II would be major and potentially significant. Agency mitigations under alternatives III and IV would reduce the potential for bald eagle mortality.

The Clark Fork and Bull rivers provide the best bald eagle nesting, foraging, and wintering habitat. Residences built close to active nests would disrupt nesting activity. Houses could also be built near feeding or wintering sites, displacing eagles from traditional use areas. Other threatened and endangered species also could be affected by residential construction.

Migrating peregrine falcons and transient gray wolves could be displaced, from areas currently or potentially used, by the increased human activity level.

Spring grizzly bear habitat would be reduced by the physical changes required to operate the mine. Grizzly bear habitat effectiveness would be reduced due to the increase in human activity. Cumulative effects of concurrent operation of the Rock Creek and Montanore projects would have significant adverse effects on grizzly bears.

Planned road closures on NFS lands for all action alternatives would increase habitat effectiveness for gray wolf and grizzly bear in areas previously open to public use for part or all of the year.

Introduction

Construction and operation of the proposed project would have direct, indirect, and cumulative impacts on some wildlife species that are Federally listed as threatened or endangered. Direct impacts result from on-site activities that alter habitat; displace individual animals from habitat they normally use; or affect the productivity, survival, or mortality of the species impacted. Indirect impacts result from those activities that occur off site or at a later time, and are not directly a part of the mine operation. Indirect impacts can also affect productivity, survival, and mortality.

Formal consultation is required between the U.S. Fish and Wildlife Service (USFWS) and KNF for protection of threatened and endangered species. In the Biological Assessment (see **Appendix B**), a determination of may adversely affect has been made for the grizzly bear and its habitat for all action alternatives and for the bald eagle under Alternative II. The USFWS will make recommendations to mitigate adverse effects that may include measures in addition to those discussed in this EIS. Informal consultation is ongoing and formal consultation will be completed prior to the record of decision.

Alternative I

Bald Eagle

Under the No-action Alternative, bald eagle use along the lower Clark Fork River would continue to increase, as evidenced by the increase in number of nesting pairs found over the past 5 years (no pairs in 1988; four pairs in 1994). Since there is no suitable nesting or winter roosting habitat in the project area, there would be no change in available habitat conditions.

Peregrine Falcon

Peregrine falcon use along the Clark Fork river drainage would remain a possibility. The suitable nesting habitat would still be available. Since bald eagles and peregrine falcons generally do not co-habit the same nesting territory, and since there is an existing bald eagle nest site within one-third mile of suitable peregrine falcon nesting habitat, the likelihood of a nesting pair moving into the area remains only fair. The use of the area by migrating peregrines could still occur.

Gray Wolf

Movement of wolves through the project area would still be possible. With additional KNF road closures occurring to meet grizzly open road density (ORD) standards, suitability for wolf movements would improve slightly. Since there are no known den or rendezvous sites in the project area and FDR No. 150 would still be open to public access, there would be no change in the availability of these two components of wolf habitat. Alternative I would have a minor beneficial effect on the gray wolf habitat effectiveness.

Grizzly Bear

The project area would continue to provide the present amount of spring and fall grizzly habitat. There would be a slight increase in habitat effectiveness due to completion of other projects in the BMUs affected by the Rock Creek Project. Closures of private roads in BAA 7-4-7 would reduce ORD to 0.62 miles per square mile. BMU 5 would retain a 0.79 miles per square mile ORD. BMU 6 would retain a 0.75 miles per square mile ORD. Two BMUs would, and one BMU would not meet the Forest Plan ORD standard (0.75 miles per square mile).

Alternative I would have a minor beneficial effect on grizzly habitat effectiveness by reducing ORD over the entire bear use period, rather than just the spring season.

Alternative II

Bald Eagle

Foraging habitat along Highway 200, FDR No. 150, and the train tracks would potentially increase due to a rise in deer mortality caused by project-related vehicular traffic. The increased food source could result in an increase in the risk of eagles being hit along these travel corridors. Bald eagles scavenging on road-kills, would gorge themselves and be unable to gain elevation rapidly when disturbed by an approaching vehicle. Their flight path would be along the road corridor, thus increasing the likelihood of being struck by vehicles.

Should a bald eagle be hit by a vehicle, and especially if that eagle was part of one of the nesting pairs using the lower Clark Fork, recovery could be delayed in the Upper Columbia Bald Eagle Recovery Zone. Impacts to bald eagles under Alternative II would be potentially significant in the short term.

The degree to which the project could effect eagles is also related to the predicted downstream effects of metals, nitrogen loads, and sediment on fish, the primary prey species and aquatic invertebrates. An increase in some toxic metals from tailings pipeline ruptures or an impoundment failure could increase stress to aquatic life (see Hydrology and Aquatics/Fisheries). Sediment and nitrogen loads would temporarily increase and impact both aquatic invertebrates and fish (see Aquatics/Fisheries); the resultant indirect effect to bald eagles would be minor.

Peregrine Falcon

Peregrine falcon use along the Clark Fork River drainage would remain a possibility. The suitable nesting habitat would still be available.

Gray Wolf

The increase in human activity for the duration of mine life would effectively eliminate the suitability of the stream bottom portion of Rock Creek for use by wolves. The increased potential for human-wolf encounters increases the mortality risk for any wolf that might choose to use the Rock Creek drainage. Mitigations to encourage carpooling by mine employees and to prohibit firearms in employees vehicles would reduce mortality risk.

Space, with limited exposure to humans, would be slightly reduced by continuous mine-related activity. This would affect an estimated 3,560 acres during construction, and 2,940 acres during the operation phase. The improved habitat effectiveness in areas where roads are closed to meet ORD standards for grizzly bear (generally in the upper reaches of Rock Creek drainage) may not compensate for reduced effectiveness on the influenced acres. This would be due to the elimination of big game winter range at lower elevations. Subsequent displacement of game, and the linkage between wolves and this prey base, would displace wolves. Other potential changes to the prey base habitat and population (see Biodiversity) also would reduce the habitat suitability for the gray wolf.

The overall habitat effectiveness for wolf may drop slightly. This is based on: 1) the project area being outside of designated gray wolf recovery habitat; 2) a lack of confirmed wolf activity in the project area; and 3) project mitigations.

Grizzly Bear

There would be a direct physical loss of 584 acres of grizzly bear habitat as a result of the proposed project. **Table 4-26** summarizes the physical changes by habitat component for each alternative.

TABLE 4-26.
Acreage of Habitat Components Physically Altered by ASARCO Project

Facility	Component	Alt. II	Alt. III	Alt. IV
Tailings Impoundment and Associated Disturbances	conifer forest	375	390	390
	graminoid park (grassy meadow)	14	14	14
Mine and Associated Features	conifer forest	30	30	0.1[1]
Exploration Adit and Support Facilities	conifer forest	10	10	10
Transportation Corridor	conifer forest	30	89	68
	forb field	2	2	2
Facilities (includes mill site)	conifer forest	59	66	58
TOTAL PHYSICAL DISTURBANCE		584	609	542

Source: Kootenai National Forest 1995.
Notes: Physical changes are 67 percent on NFS lands and 33 percent on private lands (alternatives II through IV).
[1] Mine and facilities on same location, acres shown under facilities

In addition to the acreage physically impacted by the project, the presence of humans would influence grizzly use on habitat within 0.25 to 0.50 mile of disturbed sites and human travel routes. A portion of the proposed project area currently experiences some human disturbance. Disturbance would generally be much greater because of the continuous operation of the proposed project. **Table 4-27** displays the acres influenced by disturbance under each alternative. The habitat effectiveness (percent of BMU freely available - "uninfluenced") would be reduced on an estimated 3,560 acres during construction and 2,940 acres during operations (see **Table 4-27**) because of the physical loss of habitat and the reduced availability of additional habitat, as shown in **Table 4-28**. Changes in habitat effectiveness caused by this alternative are all negative (BMU 4 is -0.8 percent, BMU 5 is -3.6 percent, BMU 6 is -1.4 percent). Denning habitat would not be disturbed by the proposed project.

The ORD density would change as displayed in (see **Table 4-29**). Additional mitigation would be needed to close 2.5 miles of FDR No. 2741 (Chicago Peak Road) and 1.9 miles of FDR No. 2285 (Orr Creek Road), in order to meet the Forest Plan ORD standard in all BAAs (see map in **Appendix B**).

TABLE 4-27.
Total Acres Influenced during Construction and Operation Phases

Alternative	Construction Phase	Operation Phase
II	3,560	2,940
III	3,695	3,075
IV	2,390	2,250

Source: Kootenai National Forest 1995.

Note* = 0.25 to 0.50 mile or ridge line depending on activity
Does not include acres from Table 4-20.

TABLE 4-28.
Percent Habitat Effectiveness Lost Due to the Proposed Rock Creek Project

Alternative	BMU 4	BMU 5	BMU 6
I	0.0	0.0	0.0
II	-0.8	-3.6	-1.4
III	-0.8	-3.6	-1.5
IV	-0.8	-2.0	-1.1

Source: Kootenai National Forest 1995.

TABLE 4-29.
Open Road Density (Mi./sq.mi.) Projections (Management Situation-1 lands)

BAA				
	Alt. I	Alt. II	Alt. III	Alt. IV
7-4-7[1]	O.62	0.62	0.62	0.62
7-5-2[2]	0.79	0.84	0.75	0.75
7-5-3	0.00	0.00	0.00	0.00
7-6-1[3]	0.78	0.80	0.75	0.75

Source: Kootenai National Forest 1995.
Notes: ORD standard is 0.75 mi./sq.mile

[1] Assumes closure of private roads in section 5 in 1997 (all alternatives).

[2] Assumes mitigation (alternatives III and IV) to close 2.5 mi. of FDR No. 2741 in year 1.

[3] Assumes ASARCO mitigation (alternatives III and IV close 2.0 mi. of FDR No. 2285 in year 1).

Grizzlies could be struck by vehicles accessing the mine or hauling ore, or be shot illegally. The presence of the mine could create an attractant that may result in a nuisance bear. Nuisance bears often are destroyed because they cannot adapt to areas without human influence. ASARCO's mitigation plan, as specified in Chapter 2, only partially would reduce potential mortality. The risks of vehicle and nuisance bear mortality would still exist. In addition, no replacement habitat would be provided. A minimum of 2,893 acres would be needed to assure maintenance of the current carrying capacity.

Additional habitat loss and modification would occur as a result of increased human population and associated housing needs. The actual number and locations of these homes are not known. Most are likely to be along the Clark Fork River and Bull rivers. While fewer homes would likely be built along the Bull River, this valley serves as a travel corridor between the East and West Cabinets (larger blocks of suitable habitat). The travel corridors areas are classified as Management Situation 3 habitat for grizzly bear (Interagency Grizzly Bear Committee 1986). Human disturbance and housing in the Clark Fork Valley may affect the linkage between the Cabinet and Bitterroot ecosystems, but linkage zone assessments are not complete. The USFWS has initiated a 5-year process to access the linkage potential between ecosystems. Linkage zones are desirable for recovery, but are not essential for delisting at this time (U.S. Fish and Wildlife Service 1993a).

Increased recreational use of grizzly habitat would increase the likelihood of displacement and/or human/bear encounters. Encounters often result in increased grizzly mortality.

All of the above affects combine to result in a reduction in habitat carrying capacity. This reduced carrying capacity may result in disruption of normal grizzly behavioral patterns, including breeding, feeding or sheltering.

Based on direct physical loss of suitable habitat and reduced habitat effectiveness, the habitat potential is reduced even further below the 70 percent minimum. Consequently, mortality risk is increased. Impacts to grizzly bears under Alternative II would be significant.

Water Howellia

No harvest, mining, or road-building activities would occur in suitable habitat. There would be no direct, indirect, or cumulative effects on this species or its habitat.

Alternative III

Bald Eagle

The mitigation for daily removal of dead animals from cleared areas along Montana Highway 200 and FDR No. 150, and carpooling mine employees would reduce mortality risk. There would be instances when eagles would find dead animals before they could be removed from the right-of-way. Relocating the rail load-out to Miller Gulch and routing ore trucks on FDR No. 150B instead of Montana Highway 200 would also reduce the potential for road-kills and associated bald eagle mortality.

The water resources and aquatics/fisheries monitoring plans (see **Appendix H**) are an integral part of the proposed action, and would be used to detect any adverse effects in the food chain used by bald eagles.

Gray Wolf

This Alternative affects an estimated 3,695 acres during construction and 3,075 acres during mine operation. Impacts to gray wolves under Alternative III would be negligible.

Grizzly Bear

There would be a direct, physical loss of 609 acres of grizzly bear habitat due to the mine proposal. Habitat effectiveness would be reduced on an estimated 3,695 acres during construction, and 3,075 during operations. Changes in habitat effectiveness caused by this alternative are all negative (BMU 4 is -0.8 percent, BMU 5 is -3.6 percent, BMU 6 is -1.5 percent).

Mitigation for physical habitat loss and reduced habitat effectiveness is planned in the form of replacement habitat. ASARCO would be required to provide 3,011 acres through conservation easements, acquisition, or other means.

The ORD would change as displayed in **Table 4-29.** With mitigation to close additional 4.5 miles of road year-long (2.5 miles of FDR No. 2741 and 2.0 miles of FDR No. 2285), this alternative would meet the maximum standard of 0.75 miles per square mile in all BAAs. Planned closure of portions of the Chicago Peak and Orr Creek roads could cause resentment toward the grizzly and could result in increased mortality risk from poaching. Mitigations proposed by the Agencies would reduce the mortality risk (see **Appendix B**).

Grizzlies could be struck by vehicles accessing the mine or hauling ore or destroyed as nuisance bears. Mitigation for these effects include busing and/or carpooling, bearproofing containers for attractants, and removing road-killed animals from roads on a daily basis.

Adverse effects to grizzly bear and its habitat cannot be fully mitigated. Impacts to grizzly bear under Alternative III would be significant.

Alternative IV

Bald Eagle

The increase in road killed-deer and the associated risk of bald eagle mortality would be essentially the same as Alternative III.

Gray Wolf

This alternative affects an estimated 2,390 acres during construction, and 2,250 acres during mine operation. The overall habitat effectiveness for wolf would be reduced slightly.

Grizzly Bear

There would be a direct, physical loss of 542 acres of grizzly bear habitat due to the mine proposal. Habitat effectiveness would be reduced on an estimated 2,390 acres during construction and 2,150 acres during operations. Changes in habitat effectiveness caused by this alternative are all negative (BMU 4 is -0.8 percent, BMU 5 is -2.0 percent, BMU 6 is -1.1 percent).

Mitigation for physical loss and reduced habitat effectiveness is planned in the form of replacement habitat. ASARCO would be required to provide 2,303 acres through conservation easements, acquisition, or other means.

All of the above affects combine to result in a reduced habitat carrying capacity. This reduced carrying capacity may result in disruption of normal grizzly behavioral patterns, including breeding, feeding or sheltering.

Although less area would be affected under Alternative IV than any other action alternative, the nature of the effects would be the same. Impacts to grizzly bears under Alternative IV would be significant.

Cumulative Effects

With the Montanore project active in two of the three same BMUs, there would be very little displacement habitat available for grizzly bears or wolves (see **Appendix B**). The cumulative habitat effectiveness in the affected BMUs also changes (see **Table 4-30**), and would be below the minimum 70 percent level in two of the three BMUs. In addition, when and if the two mines operated, the north-south corridor along the crest of the Cabinet Mountains would become extremely narrow and could limit grizzly bear and wolf movements between the southern and northern portions of the Cabinet Mountains. Elimination of movement along the ecosystem is not likely, but changes in individual bear behavior are. Changes in behavior could result in increased competition for habitat or territory in the restricted area. It could also result in mortality to bears that were forced to move through disturbed areas.

Future timber sales would physically change additional grizzly habitat components, especially by removing conifer forest and creating shrub/forb openings. This type of activity also has the potential to decrease the percent of BMU(s) available for undisturbed use by grizzly bear (reduce habitat effectiveness). Timber sales can also result in increased road densities, which contribute to increased human/bear encounters, that lead to more bear mortalities. Cumulative impacts to grizzly bears would be significant.

TABLE 4-30.
Lowest Percent Habitat Effectiveness Reached During Project Period by Alternative

Alternative	BMU 4	BMU 5	BMU 6
I[1]	64.3	67.5	71.0
II	64.3	65.1	71.0
III	64.3	65.1	70.9
IV	64.3	66.1	71.2

Source: Kootenai National Forest 1995.
Note: Minimum Acceptable Habitat Effectiveness is 70 percent.
Assumes Noranda Montanore project part of existing condition and road closures in place.
[1] Changes from existing condition shown for Alternative I are the result of cumulative effects from other projects.

SOCIOECONOMICS

Summary

The socioeconomic effects associated with the Rock Creek project would occur primarily in western Sanders County: Alternative I would allow development of over 1,000 new Sanders County jobs over the next 25 years, primarily in service industries. Local population growth rate are expected to be above statewide rates, generating increased demands for housing and community services.

Alternatives II and III would cause a substantial influx of construction workers (up to 433 workers), who would generally depart after 1 year's employment. Mine operations would directly boost local employment by an estimated 355 jobs (including an estimated 200 workers from Sanders County -- a 5 percent increase), and would hamper sustainable local economic growth and diversification for many decades. Mine facilities would substantially increase Sanders County and the Noxon school district tax bases. Local tax revenues would be shared with other affected jurisdictions and with the state of Montana as specified in the negotiated Hard Rock Mining Impact Plan.

Indirect project effects include increased needs for community services. Some fiscal impacts would be moderated by the negotiated Hard Rock Impact Plan. Depending on the residential locations of immigrating families, school enrollment increases could exceed local school capacities and/or accreditation standards. Some water and sanitation systems are inadequate to serve project-generated growth. Land use along the Clark Fork and Bull River valleys would sustain conversions of about 140 acres to residential and commercial development. About 400 acres of private lands in the proposed impoundment area would be restricted from other uses into the long term. Impacts associated with alternative II and III would restrict uses on about 3,000 of private lands for permanent protection of the grizzly bear.

Alternative IV would have effects similar to alternatives II and III but mine development scheduling would moderate the construction worker influx (a peak employment of 350 construction workers for 1.5 years), mitigating major negative socioeconomic effect of project construction -- the boom/bust development cycle. Land use impacts from grizzly bear mitigations would involve 2,300 acres of private lands.

Alternative I

Local Population and Economy

Over the next 30 years, the population of Sanders County is projected to moderately increase (0.8 percent average annual growth) from 8,800 persons in 1992 to 10,800 persons in 2020 (NPA DATA Services, Inc. 1993) (see **Figure 4-2**). Local populations have recently jumped at a 5 percent annual rate to 9,700 persons (U.S. Bureau of Census 1995) primarily due to retirees moving to the area. The projected county population growth (2,000 persons or a 23 percent increase by the year 2020) is expected to be slightly above statewide Montana growth rates (0.7 percent annual growth) through the year 2020 (NPA DATA Services, Inc. 1993).

Sanders County is expected to continue its long-term economic transition from a resource-extraction economy to a services-, investment-, and retirement-based local economy. The county's moderate economic expansion projected through the year 2020 would come almost exclusively from growth in various services (primarily health, lodging, repair, education, legal, recreation, finance, insurance, and real estate), new entrepreneurs, and working retirees (Northwest Policy Center 1995). Over the next 30 years, service employment is expected to continue increasing from their existing 25 percent share of the county economy toward the 75 percent share that services (including trade and government) currently have in the Montana and United States economy (Sohn 1992; Sinai 1990). Local resource-extraction industries, such as logging, mining, and energy, would continue their long-term economic decline (Swanson 1992 a, b; Deavers 1989).

Sanders County is expected to continue a major transition to a balanced and growing economy, sustaining social and economic diversity. Alternative I would have long-term socioeconomic benefits.

Sanders County employment is expected to increase to 4,600 persons (1,000 additional jobs or 0.8 percent annual growth) by the year 2020, boosted by service employment growth and a maturing local work force. The rate of local young workers entering the work force is expected to be less than current levels. Local per capita incomes are projected to remain below statewide averages (Bureau of Economic Analysis 1992). For the next several decades, dependence on cyclical and declining resource-extraction industries will elevate local unemployment rates (Freudenberg and Frickel 1994). Sanders County's shift to more stable service industries will bring local unemployment rates down toward statewide averages.

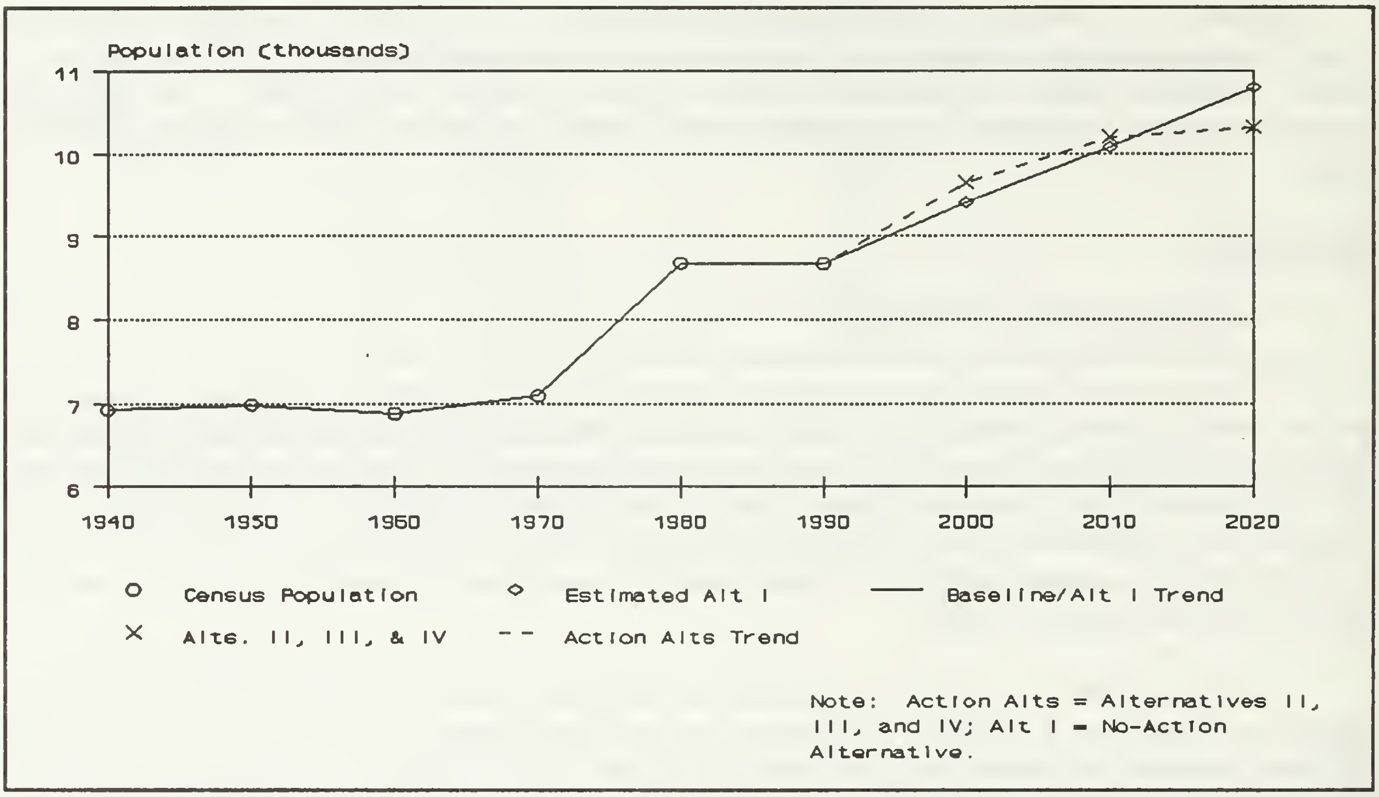


Figure 4-2. **Historic and Projected Sanders County Population**

Community Services and Housing

Community service needs are likely to outstrip the ability of local jurisdictions to pay for them (Nicholson 1992). These growing needs may increasingly burden schools, law enforcement, fire, health, water, sewer, library, and human service providers. Fees and other non-tax revenues could be used to provide these services (Young 1992).

Over the next 30 years, housing supply is expected to increase at rates slightly greater than the rate of population growth as smaller families -- primarily retirees and older childless couples -- make up greater percentages of the local population (NPA DATA Services, Inc 1993). About 500 new housing units are expected to be constructed, primarily single family homes and mobile homes. Rental housing availability is expected to remain scarce because substantial numbers of residents will be unable to afford to buy a house, or will be unwilling to make a long-term purchase.

The project's anticipated social and economic effects on area private and public sectors would not occur. Boom/bust population impacts, new mine jobs, and additional regional income would not occur nor would project-generated needs for community services and housing.

Land Use

Rock Creek drainage is expected to receive reduced timber cutting over the next few decades. The private lands along Rock Creek, in the Clark Fork Valley, and the Bull River could be developed for residential and recreational uses in the future.

Alternatives II and III

The primary factors influencing possible Rock Creek Project socioeconomic impacts are:

- project employment and schedules;
- availability of a locally skilled/trainable work force;
- project-influenced worker immigration rates; and
- the ability of local communities and ASARCO to address project impacts.

Local Economy

Mine operations would provide a substantial local employment and economic boost over mine life but would hinder development of significant portions of the 1,000 estimated new jobs in the currently expanding services sector, and would decrease attractiveness to retirees (Swanson 1991 and 1992c; Baden and O'Brien 1994; Krannich and Luloff 1991; Rasker 1992). Up to 300 local jobs in this sector may be foregone over the next 3 decades because of the project's secondary economic and social effects (Heffner 1991; Power 1992; Swanson 1992a; Nord and Luloff 1992). Increases in local wages and business costs would make the area less attractive for new or expanding businesses and would reduce area economic growth in later decades (Nord and Luloff 1992). Mine development would significantly hinder western Sanders County's capacity to diversify its economic base using its natural amenities, quality of life, and competitive cost structures to lure retirees and foot-loose newcomers (Johnson and Rasker 1993; Jobes 1992).

Project Employment

Project employment effects would be concentrated in western Sanders County. Peak project employment would require up to 200 local construction workers and up to 233 out-of-area immigrating construction workers. Bonner County (Sandpoint) and Lincoln County (Troy and Libby) would experience minor effects from this employment (ASARCO, Incorporated 1987 - 1994). Project employment effects would involve four phases: an exploration adit, mine construction, mine operation, and mine closure/rehabilitation (see **Table 4-31**).

TABLE 4-31.
Project-Related Employment Characteristics

	Year 1 Expl. Adit Construction		Mine Construction and Development						Mine Operation Years 5 - 35		Mine Closure
			Year 2		Year 3		Year 3				
Employment and Work Force type	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half	Year 5	Year 35	Year 36 & 37
Project Planning and Exploration Adit Construction (contracted workers)											
Adit Construction	32	54	-								
Mine Construction (contracted workers)											
administrative			20	25	25	-	-	-			
technicians[1]			20	25	15	-	-	-			
mechanics			78	52	65	-	-	-			
equipment operators			93	155	167	-	-	-			
laborers			37	53	63	-	-	-			
CONSTRUCTION TOTAL			248	310	345	0	0	0			
ASARCO Employment in Mine Construction, Operations and Closure											
administrative	8	9	12	15	20	20	28	35	45	45	5
technicians[1]			17	20	25	20	28	15	60	45	5
mechanics			3	9	15	11	15	35	60	60	5
equipment operators			3	20	28	11	50	100	150	150	45
laborers			3	9	10	11	25	15	60	45	5
MINE TOTAL			44	81	88	100	130	240	355	350	35
TOTAL PROJECT EMPLOYMENT											
	40	62	292	391	433	100	130	240	355	350	35

Estimated average semiannual employment levels from ASARCO, Incorporated 1987 - 1994.

[1] Technicians include lumbermen, welders, machinists, electricians, warehousemen, carpenters, and janitors.

Exploration adit construction employment would peak at 62 workers in the last half of year 1. Mine construction employment would peak at 433 workers during the middle of year 3. (See **Table 4-31 and Figure 4-3.**) Mine operations would maintain a work force of about 350 workers for 30 years. The distinction between mine construction and mine operation is important because project development usually has a higher direct impact on local socioeconomic conditions (Wenner 1992). There would be

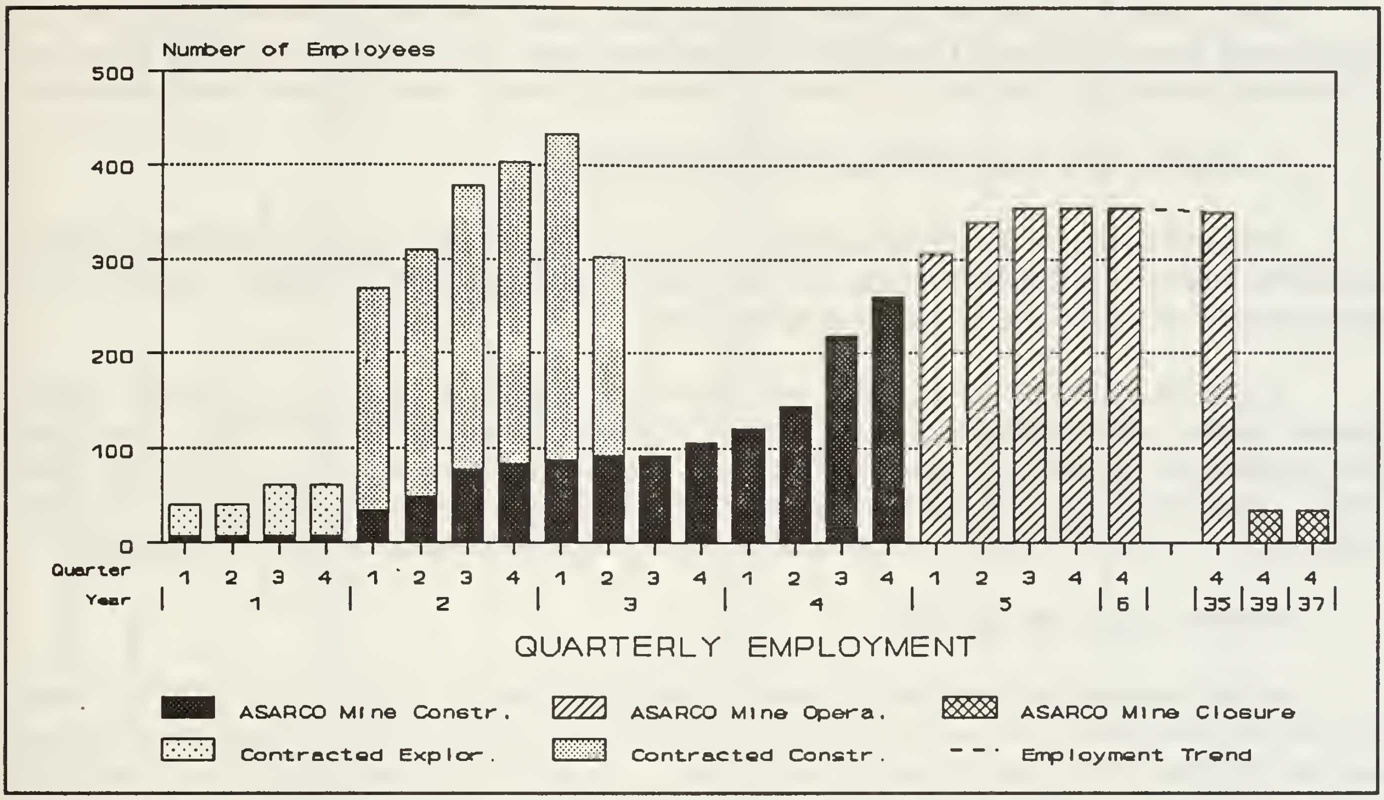


Figure 4-3. **Alternatives II and III Employment**

Source: ASARCO, Incorporated.

almost 2 years between peak construction and operations employment. Mine closure and reclamation activities would require about 35 workers. Actual project employment would be expected to vary from these estimates, depending upon mine construction scheduling, construction progress, and the resources ASARCO would apply toward full-scale operations.

Mine employment would stimulate limited secondary local employment. Because of the transient nature of construction work, the construction work force would have very low levels of indirect job creation (estimated 0.2 indirect jobs per construction job). On the other hand, since mine operations jobs would last much longer and these workers would all reside in the local area, this employment would be expected to generate 0.4 indirect local employment jobs per mine employee. These indirect employment multipliers are estimates based on recent Montana mine development experiences, adjusted to accommodate the fact that the Sanders County residents make many purchases outside the local area. These multipliers do not include effects of possible major local purchases of services or goods by ASARCO. These multipliers may change if ASARCO chooses to make substantial local purchases or if Sanders County becomes more economically self-sufficient.

The construction peak could generate indirect employment for up to 70 temporary workers. In the following 30 years, the Rock Creek Mine would generate about 140 indirect jobs, of which 90 percent (124 workers) would be hired locally and about 10 percent (16 persons) would be hired from immigrants.

Availability of a Locally Skilled/Trainable Work Force

About 50 percent of the contracted construction work force would be hired from existing workers in Sanders, Bonner, and Lincoln counties (see **Table 4-32**). This analysis further assumes that an out-of-area contractor would be selected for mine construction.

About 80 percent of the ASARCO mine operations workers would be hired from the existing Sanders, Bonner, and Lincoln county work forces. This ratio is based on ASARCO hiring rates at the Troy mine and the company's proposed intensive local worker training program (ASARCO, Incorporated 1988). **Table 4-32** estimates local hiring rates by worker type (based on anticipated work force composition). ASARCO would be expected to provide intensive training for workers lacking skills.

Worker/Family Immigration

Mine Construction/Development Immigration and Settlement. A short-lived (up to 1.5 years) construction immigration boom of up to 483 persons (230 construction workers, indirect workers, and their families) would be expected to move into the area. A number of the immigrating mine construction workers would be expected to bring their families with them. About 60 percent of immigrating construction workers would be expected to be married and have an average of 0.8 children; an average family size of 2.1 persons. At the peak of mine development, up to 138 spouses and 115 children of 230 construction-related workers would move into the area for up to 1.5 years (see **Table 4-33**). Completion of contracted mine construction would cause 90 percent (up to 200) of the mine construction workers and an estimated 225 family members to leave in year 2. Early in year 4, all of the estimated 20 to 30 immigrating mine workers would work directly for ASARCO and would be accompanied by up to 30 family members. Some contract construction workers could remain in the area awaiting possible employment in mine operations. Late in year 4, mine operations startup and shakedown would start a second immigration with an additional 50 immigrating ASARCO employees (see **Figure 4-3**) and 130 new mine-associated immigrants.

Of the 483 peak construction-phase immigrants, an estimated 315 (65 percent) would be expected to reside in Sanders County, creating a substantial (6 percent) but short-lived (about 1 year) increase in local population (see **Table 4-33**). Bonner and Lincoln counties would experience the remainder of the mine development influx, receiving 95 and 72 persons, respectively. These temporary population increases would be insignificant (0.3 percent Bonner County and 0.4 percent Lincoln County). Construction worker families would have left the area about 1 year before a much smaller immigration wave of mine-operations-related families arrived.

TABLE 4-32.
Estimated Local Hires by Job Type for All Action Alternatives

	Alternatives II and III		Alternative IV		Estimated Local Hire ratio (%)
	Total Project Employment	Estimated Local Hire[1]	Total Project Employment	Estimated Local Hire ratio (%)	
Construction employment (short-term peak level)					
administrative	30	6	37	7	20
technicians[2]	30	10	52	18	35
mechanics	60	24	100	40	40
equipment operators	165	80	68	34	50
laborers	60	55	91	82	90
CONSTRUCTION TOTAL	345	175	348	181	50
Mine Employment (30 Years of Operations)					
administrative	45	27	45	27	60
technicians[2]	40	32	30	24	80
mechanics	60	36	51	30	60
equipment operators	150	128	164	140	85
laborers	60	60	50	50	100
MINE TOTAL	355	283	340	271	80

Source: Alternatives II and III are Estimated from ASARCO, Incorporated 1987 - 1994.
Alternative IV is estimated from ASARCO, Incorporated 199

Note: [1] Local hires include persons residing in Sanders, Bonner, or Lincoln counties prior to project startup.
[2] Technicians include lumbermen, welders, firemen, mechanists, electricians, warehousemen, carpenters, and janitors.

TABLE 4-33.
Expected Settlement Locations of Immigrating Mine and Construction Workers for Alternatives II and III

Community	Miles to Lower Mill Site	Approx. Population[1]	Existing Housing Stock[2]		Immigrating Worker Settlement[3]				Immigrant Population[3]	
					Construction[3]		Mine Operation		Construction[3]	Mine Operation
SANDERS COUNTY		8,700	Total	Vacant	Workers	%	Workers	%	Persons	Persons
Noxon/Heron area	13	1,100	750	240	80	35%	10	35%	164	10
Trout Creek area	13	1,300	500	80	10	13%	15	18%	62	10
rural Thompson Falls	35	400	260	90	19	9%	10	11%	41	25
Thompson Falls	39	1,800	700	60	30	6%	6	6%	41	15
Plains area	65	1,100	500	75	1	1%	0	0%	2	0
study area subtotal[1]		5,700	2,700	530	150	65%	60	70%	315	160
BONNER COUNTY, IDAHO		27,000								
Clark Fork area	32	600	350	80	19	8%	8	8%	41	10
Hope area	42	400	260	100	8	4%	4	5%	17	10
Sandpoint area	57	8,000	4,900	1,800	18	6%	6	6%	38	15
study area subtotal[1]		9,000	5,500	1,800	18	20%	18	20%	95	45
LINCOLN COUNTY		18,000								
western Lincoln County	46	1,300	600	400	11	4%	4	5%	23	10
Troy area	49	1,200	500	600	10	3%	3	6%	20	10
Libby area	65	3,300	1,600	330	18	6%	1	6%	30	2
study area subtotal[1]		5,800	2,700	600	35	15%	8	15%	73	22
3 COUNTY POPULATION[1]		53,700								
TOTAL STUDY AREA[1]		20,500	10,900	3,100	230	100%	86	100%	483	227

Source: ASARCO, Incorporated 1987 - 1994.

U.S. Bureau of Census 1993.

Note:
[1] Population estimates for study areas of each county do not add up to the total county population.
[2] Housing stock includes all seasonal and permanent housing, including housing for rent, for sale or vacant.
[3] Family and population figures include immigrating mine employees and other workers who immigrate to take derivative employment induced by the project. Construction estimates are for the peak construction employment.

Mine Operations Immigration and Settlement. The ongoing mine operations would cause the immigration of an estimated 86 mine and indirect workers starting in year 5. All of these workers would be expected to bring their families into the area (see **Table 4-33**). The average mine worker family size would be expected to be 2.6 persons, assuming that 75 percent of the mine workers were married and had an average of 1.2 children. This would total an influx of 227 persons for the next 30 years including 65 spouses and 77 children (see **Table 4-33**).

During operations startup (years 4 and 5), about 160 persons would move into Sanders County, increasing county population by about 2 percent. Likewise, Bonner and Lincoln counties would be expected to have population increases of 45 and 22 persons, respectively (0.15 percent, respectively). **Table 4-33** shows the expected local settlement patterns of immigrating mine operations and indirect workers and their dependents. Based on patterns from the ASARCO Troy Mine about 50 to 100 additional families (about 160 persons) would be expected to accompany unsuccessful job-seekers into the area (Wenner 1992). Based on a 20 percent annual work force turnover (about 70 workers), the local population would fluctuate by about 180 annually. Local mine workers would be expected to relocate to housing nearer the mine when it became available.

Overall, the location and availability of affordable housing is likely to determine the settlement patterns of mine development and mine operation families (see **Table 4-33**).

Temporary Mine Shutdown

Temporary project shutdown would cause a short-term loss of direct local employment. The effects of such a shutdown on indirect employment would depend on the length and nature of the shutdown.

Permanent Mine Closure

Mine closure would cause the loss of an estimated 350 direct and 126 indirect jobs, with mine reclamation expected to employ approximately 35 workers for at least 2 years (see **Figure 4-3 and Table 4-32**). In 1993, about two-thirds of workers from the Troy Mine entered retraining programs; about half remained in the area 2 years after shutdown (Mike Bissell, Libby Job Service, personal communication, March 7, 1995). Because mining skills are difficult to transfer to other local employment, a Rock Creek Mine closure would be expected to cause one-half of the mine workers to leave the area, generating an exodus of 175 workers and 462 other local persons. The remaining workers would enter retraining or unemployment programs, or would retire from the work force. In a short period of time, the mine's local indirect employment effects would disappear.

Income

Based on the estimated 355-employee payroll, the average mine worker would earn about $27,000 per year, generating an estimated annual project payroll of $9.6 million (see **Table 4-34**). These estimates are consistent with regional mining wages. Indirect employment associated with the mine (estimated 140 long-term workers) would generate an additional annual local income of $1.5 million.

TABLE 4-34.
Estimated Direct Payrolls from the Rock Creek Project

Project Year	Total Payroll (millions of 1992 $)	Average Annual Wages (1992 $)[1]
Year 1	0.16	27,000
Year 1	4.99	31,000
Year 3	10.60	31,000
Year 3	7.74	29,000
Year 5	4.99	27,000
Years 6 to 35	9.59	27,000
Years 36 and 37	0.95	27,000
Year 38	minimal	unknown

Source: Bureau of Economic Analysis 1993: Montana Department of Labor and Industry 1993 for wages only. Total payroll is estimated from ASARCO's employment numbers.

Altogether, project direct and indirect income would increase the three-county total income by $11 million, or 2 percent of total, $613 million (1990). Indirect and direct increases in Sanders County would be an estimated $9.8 million (10 percent county increase). In addition to employment income effects, ASARCO could make noticeable purchases of local supplies and services, increasing other business incomes.

Project employment would be expected to raise local wage structures and to cause increased rates of job shifting during project development. These effects would increase local businesses' costs, making some businesses less competitive in national markets and would decrease the rate of local business growth and job creation. Some local employment and income may be displaced as regional outlets come in to serve local markets (Wenner 1992).

Fiscal Effects

Increases in local government costs would be anticipated as a result of project development. These costs to cities, schools, and Sanders County would result primarily from mine-related immigration into the area. They would include additional government staffing, capital outlay, and increased support costs.

The proposed project would generate direct increases in government revenues. These revenues would come from the following sources:

- property tax on ASARCO property and mine and mill facilities;

- Metal Mines License Tax and/or;
- the assessed value of new homes and businesses indirectly associated with the project.

Property Taxes. Local governments depend on property taxes for roughly 40 percent of their total revenues. The proposed project would generate new property tax revenues to Sanders County and Noxon school districts from property taxes on ASARCO's mine and mill facilities. Local government revenues would come from the real and personal property taxes on mine lands, construction improvements, pollution control systems, and mining equipment. Montana law provides for tax-base sharing among local governments when a mine is designated as a large-scale mineral development (see Hard Rock Impact Plan), so local revenues would not directly track with property value changes.

The mine's taxable value would be expected to increase slowly during the 3-year mine construction phase ($15 million), and peak in the first two years of mine operations ($60 million). The actual property tax revenues from this increased taxable value would depend on the local mill levies rates, state property tax equalization effects, and the timing of property tax payments negotiated through the Hard Rock Impact Plan. The mine's taxable property value would decline as the mine facilities and equipment tax value depreciated at a 5 to 8 percent annual rate, reaching fully depreciated tax values in 10 to 15 years ($12 million). After about 10 years (depending on the depreciation schedule), the property tax revenues from the mine facilities would decline below the level of the revenues from the Metal Mines License taxes.

During year 5 the mine would make up about 18 percent of Sanders County's total property tax base. Assuming the present local mill levies would be in effect, the local jurisdictions could receive up to a total of $1.06 million in additional property tax revenue from the mine during the peak year. This peak would then consistently decline to approximately $0.1 million near the middle of mine operations.

Noxon school district property tax base valuation would have a peak increase of 100 percent during the second year of mine operation. When a school districts levy receipts increase, the state equalization contribution decreases. Therefore, the district's total annual revenues would increase by only a small amount.

Additional local tax revenues could be generated indirectly from increased local property values, new worker residences, and increased amounts of local real property (e.g. equipment and vehicles).

Metal Mines License Tax

The state would impose a metal mines license tax on the mine's annual gross proceeds in excess of $250,000. This tax is a 1.8 percent tax on the value of ore concentrate shipped to a refinery. The gross proceeds tax revenues would fluctuate depending on silver and copper prices and annual rates of production. Based on an annual mine production rate of 49 million pounds of copper and 5.9 million ounces of silver, annual mine revenues of up to $60 million would generate metal mines license tax revenues of $0.8 to $1.1 million dollars (based on copper at $1.20 per pound and silver at $6.00 per ounce). Seventy-five percent of the revenues are allocated to Montana's general fund.

The remaining 25 percent of the metal mines license tax revenue is allocated to local county governments, in this case Sanders County, and distributed through the county to appropriate departments and districts. This annual revenue total is estimated at up to $280,000. Substantial portions of these funds would not be available as current revenue to the county. By law, the county must reserve at least 40 percent of this revenue for a trust fund account which can be expended only when a 50 percent reduction in the mine work force occurs. The remaining local funds (up to $168,000 annually) would be divided between the county and Noxon school districts.

Hard Rock Impact Plan

Because the project would be of sufficient size to generate local government cost/revenue disparities, and exceeds legal thresholds, ASARCO is preparing a Hard Rock Impact Plan to be submitted to Sanders County. If a negotiated agreement between ASARCO and the county cannot be reached, the plan would be adjudicated by the Hard Rock Impact Board before final project permits may be approved. This plan would provide a coordinated mechanism for allocating project tax revenues to affected local government jurisdictions that would experience project impacts, but that would not receive appropriate tax revenues from the project, or where project tax revenues would lag behind project-generated service increases. This is the case when adjacent school districts would enroll mine-family students, but would not have mine property value increases, or when worker generated school enrollments jumped before local property tax collections increased. ASARCO would negotiate Hard Rock Impact mitigations possibly including in-kind tax pre-payments, grants, guarantees of facility impact bonds, or other appropriate methods to alleviate inequities in location and timing of government receipts. These payments generally would be treated as credits against the company's future tax liabilities.

The impact plan would identify the increased capital, operating revenues, and net operating costs to affected local government jurisdictions resulting from mine development. ASARCO would be required to negotiate how it would address projected incremental effects on local government capital and operating costs identified through the impact plan process. The plan would include an ASARCO payment schedule and project conditions that would trigger adjustments or amendments to the plan. The Hard Rock Impact Act would require monitoring by ASARCO and local government jurisdictions so that discrepancies between the planned project impacts and actual project impacts could be accommodated. The specific fiscal effects of ASARCO's impact plan cannot be described with any accuracy at this time.

Community Services

Under alternatives II and III, local governments would have to provide services to rapidly fluctuating populations. Local service providers may need to respond to this by rapid change in staffing and management methods (Wenner 1992).

Schools. It is estimated that about 80 percent of the immigrating children (peak of 115 total children during construction and an average total of 78 immigrating children during mine operations) would be of school age and would enroll in area schools (including at least one child with special education or gifted services needs). An estimated 20 percent of these immigrating children would not attend school (preschool, school dropouts, and homeschooled children). Immigrating school children would increase western Sanders County school enrollments by 4 percent (60 students) during the peak of mine construction and by 3 percent (44 students) during mine operations (see **Table 4-35**). Schools outside Sanders County would experience much smaller increased enrollments.

TABLE 4-35.
Immigrating Children by County

	Number of Children (Peak) during Construction Phase				Number of Children during Operations Phase			
County	Not in School	Grades K - 8	Grades 9 - 12	Total Children	Not in School	Grades K - 8	Grades 9 - 12	TOTAL Children
Sanders	15	41	19	75	10	30	14	54
Bonner	5	13	6	24	2	9	4	15
Lincoln	3	9	4	16	2	4	2	8
Total	23	63	29	115	14	43	20	77

Peak school enrollment would increase during year 2 of construction, when student immigration would boost the three-county school enrollments by 63 elementary and 29 high school students (see **Table 4-35**). This influx of new students may exceed school classroom capacities and school accreditation standards in Noxon and Trout Creek schools. Additional classrooms or a temporary waiver of school accreditation standards could be necessary. While other area schools would have sufficient classroom space for these projected enrollment increases, local residents and school administrators may wish to maintain current educational quality by hiring additional teachers rather than increasing class sizes. Rapid student turnover would necessitate increased school workloads to accommodate students with differing educational backgrounds, and to acclimate new students. A departure of students would occur with the end of mine construction.

The start of mine operations 1.5 years later, would generate an estimated influx of 63 students, of which 44 would be expected to enroll in western Sanders County schools (see **Table 4-35**). This would increase student enrollments in western Sanders County from about 1,400 to 1,444, an increase of 3 percent. This increase would place a lesser stain on school facilities than earlier mine construction-related enrollment fluctuations.

Law Enforcement. Project-generated population growth would increase vehicular accidents, domestic disputes, and criminal activities (Wenner 1992). Increased local staffing would be needed to bring law enforcement up to accepted standards. The project may bring additional law enforcement problems if significant numbers of immigrants are unable to find work or if construction workers become unemployed.

Increased traffic and accidents, particularly on Montana Highway 200, would require increased law enforcement by the Montana Highway Patrol.

Fire Protection. The Noxon, Heron, and Trout Creek Rural Volunteer Fire departments would receive additional calls from the new residents. Existing district equipment and staff are considered minimal (ASARCO, Incorporated 1988). The estimated population increase of 100 to 170 persons in the Noxon/Heron area would increase fire protection needs by roughly 15 percent. It is unclear what arrangements would be used to provide fire protection for ASARCO's mine and mill facilities.

Ambulance Services. Volunteer ambulance services in Noxon and Trout Creek would be expected to receive additional emergency calls resulting from increased local residents and related injuries and accidents. These effects are unlikely to exceed ambulance service operating requirements.

Hospitals and Physicians. Bonner General Hospital in Sandpoint, Saint John's Hospital in Libby, and Clark Fork Valley Hospital in Plains would experience slight increases in admissions from immigrants and their related health problems. These hospitals have adequate staff and facilities to serve increased admissions.

Water Supply. The estimated long-term increase of 15 households on the Noxon water system and of seven households on the Heron system would be expected to overtax existing systems. The Trout Creek, Thompson Falls, Clark Fork, and Hope water systems could readily accommodate small water demand increases from expected project immigrants. Outside of these water service areas, water for new residences would likely be supplied from private wells. Ground water resources are generally sufficient for expected household needs. Specific local ground water availability has not been established and may be insufficient in local areas.

Wastewater Treatment. Since the Thompson Falls sewage treatment facility is near capacity, demands from immigrating families would be difficult to accommodate. Growth could require additional municipal waste treatment capacity or could force new residential and commercial construction outside of the city limits of Thompson Falls. Most new rural residences would rely on septic tanks for new residential wastewater disposal. Potential problems with construction and operation of new septic systems would be evaluated by on a case-by-case basis as part of county sanitation permitting.

Solid Waste Disposal. Residential and commercial refuse collected in Sanders County is transported to a regional landfill in Missoula by Waste Management Incorporated. Additional refuse generated by mine-related residents would increase local waste generation by about 5 percent. Additional refuse generated by the mine would also be hauled to the regional landfill.

Human Services. Project employment would be expected to lower local county unemployment, welfare, and social service payments. Incoming workers and/or laid-off workers and their families would be expected to increase demands for some local social services such as family financial support and housing assistance. Unknown numbers of job seekers could move into the area. If these persons were unsuccessful in obtaining employment, they would increase the number of persons needing assistance.

Libraries. Public library use in Thompson Falls would increase as a result of project immigration. If additional funds to meet these increased service needs were not available, changes in service quality and library operations could occur.

Housing

The project would create a peak housing demand early in the second year of construction when an estimated 230 additional households (including construction, operations, and indirect workers) would be expected to immigrate into the area (see **Table 4-33**). During the mine-development phase, about 80 immigrating households would be located in the Noxon/Heron area. The distinction between mine construction and mine operations families is important because immigrating construction workers are temporary residents, who normally use temporary housing such as apartments, mobile homes, and motel rooms, and may return to their permanent homes on weekends. While area housing markets are likely to continue to change in the future, rental housing markets in the area have generally been limited. The construction worker influx would be expected to create a substantial rental housing shortage in the project area. A moderate-sized mobile home court (roughly 25 units) or an apartment building may be developed to meet these rental housing shortages. ASARCO is not proposing to develop a work camp.

Mine operations workers are generally permanent residents who would be more likely to purchase existing, new, or mobile homes. The estimated mine operation immigration would place much less strain on local housing supplies than would the earlier immigration of construction workers. Approximately one-half of the immigrating mine operations families (40 families) would be expected to reside in the Noxon/Heron area (see **Table 4-33**).

Influxes of workers, both during mine development and operations, would cause local housing shortages, generating increases in housing costs, including property taxes. Some seasonal housing could be converted to long-term occupancy (Wenner 1992). Increased housing costs would have the most noticeable effect on fixed-income and elderly residents. Overall, the location and availability of affordable housing would be likely to determine the settlement patterns of immigrants.

Social Well-Being and Quality of Life

Local residents are highly attached to local communities as demonstrated by continued willingness to endure high levels of unemployment, scarce social opportunities, and fluctuating economic conditions (Wenner 1992). New residents and businesses are attracted by recreational opportunities, high environmental opportunities, and desirable settings for families (Baden and O'Brien 1994; Johnson and Rasker 1993; Northwest Policy Center with U.S. Bank 1995).

Local dependence on national markets and outside economic decisions have supported lifestyles which accept economic fluctuation and its associated population changes, instability, and lost opportunities as normal (Freudenburg 1992). Dependence on repeated natural resource cycles has caused major fluctuations in area quality of life. Mine construction would have a negative short-term effect on local social well-being and quality of life because of rapid population fluctuations generated by project construction (Wenner 1992). After mine closure, displaced mine workers require extensive retraining with unknown results.

Economic and social dependence on resource extraction industries is widely regarded as an economic and social liability because it ties social well-being to declining economic sectors (Baden and

O'Brien 1994). Mining dependence decreases local social and economic capacity by hindering local flexibility, capability, and diversity of social processes (Freudenburg 1992). The project would be expected to increase local labor costs, decrease average education levels, and weaken the sense of community (Swanson 1992c; Freudenburg 1992). Mining dependence increases underemployment and decreases community adaptability (Krannich and Luloff 1991).

Local residents who believe that project benefits are vital to community viability would tend to view project social problems as reasonable tradeoffs for three decades of mining employment. Those who value small town communities, rural scenic qualities, a sustainable diversified local economy would tend to view the mining costs to be greater than its benefits.

Impacts to social well-being under Alternative II and III would be significant.

Land Use

Land-use-related impacts associated with transportation, recreation, wilderness, and wildlife are described in sections of the same name and in Biodiversity and Threatened and Endangered Species. Land use impacts on NFS lands are discussed under Forest Plan.

About 400 acres of private lands at the impoundment site, would become unsuitable for most other uses. This site possibly could be logged 8 to 10 decades after mine closure but probably would not support the same level of harvest as surrounding lands. A new load-out at the Hereford rail siding would increase industrial uses by 0.5 acres at the Hereford rail siding for Alternative II and at Miller Gulch for alternatives III and IV.

Indirect land use impacts would include residential and commercial development associated with mine workers. Land development, particularly along Montana Highway 200, would cause changes in land use patterns along the Clark Fork and Bull River valleys. At least one new mobile home park, occupying up to 10 acres, could be developed to serve construction workers. This development could generate the need for new infrastructure.

New residential development would be expected to convert agricultural and forest land uses. If one-third (112 workers) of the total employees were to construct new homes on 1 acre lots, a total of 112 acres would be converted to residential uses. The bulk of this new housing development would be expected in the vicinity of Noxon, Heron, and Trout Creek, Montana, and Clark Fork, Idaho (see **Table 4-33**). Up to 15 new homes (15 acres) could be developed in the Bull River Valley. An additional 15 acres may be converted for commercial activities. These land-use conversions would be minor, having little effect on area agricultural or forestry uses.

In addition to the impacts listed above, alternatives II and III would involve the acquisition of or placement of conservation easements on about 3,000 acres of private lands for grizzly bear mitigation. (2,893 and 3,011 acres, respectively. This would remove those lands from future residential and commercial (including timber harvest) development.

Alternative IV

Project Employment

This alternative would reduce some of the negative construction period population effects by more moderate sequencing of mine construction activities. This alternative's younger adits would take more time to drive and the lower mill site would be developed on waste rock from the adits. Therefore, adit, mill, and impoundment construction could occur in a more ordered sequence. Sequential work scheduling would generally limit total construction-phase workers (including contracted construction and direct ASARCO employees) to about 350 (see **Figure 4-4**). This would spread portions of mine development and construction work over 4 years, with a typical construction job lasting 1.5 years. This reduces the amount of time between the maximum construction and operations employment to 6 months. The longer construction and development period would have a construction-phase employment multiplier of 0.22 (estimated 76 total construction-phase indirect workers).

Worker/Family Immigration

Alternative IV would have a peak construction phase population influx of 380 persons (see **Table 4-36**). Families would be expected to reside in the area for up to 2 years.

In the fourth year of mine construction and development, mine operation startup and shakedown would begin a second immigration wave with and additional 20 immigrating employees and about 50 mine-associated immigrants (family members and indirect workers).

The major indirect socioeconomic effect of this alternative would be to reduce the construction employment population to more nearly match the long-term employment and immigration levels of mine operations. Estimated local hires by job type are shown on **Table 4-36.**

Community Services

Because construction-phase immigration levels would be about 80 percent of alternative II and III levels, Alternative IV would have reduced negative impacts on schools and other public service providers. The three-county school enrollments would increase by 50 elementary and 23 high school students. The Sanders County school enrollments during construction would total about 48 additional students, closely matching the 44 long-term new students during mine operations (see **Table 4-35**). The average mine-construction family would stay in the project area for several months longer than under Alternative II, which could increase the duration of peak community service demands.

Housing

About 180 immigrating families would seek housing during the first 2 years of mine construction and development. The peak construction-period housing demand would occur in the third year of mine construction and development (year 4) when an estimated 84 households would immigrate into the area (see **Table 4-36**).

TABLE 4-36.
Expected Settlement Locations of Immigrating Mine and Construction Workers for Alternative IV

Community	Miles to Lower Mill Site	Approx. Population[1]	Existing Housing Stock[2]		Immigrating Worker Settlement[3]				Immigrant Population[3]	
					Construction[3]		Mine Operation		Construction[3]	Mine Operation
SANDERS COUNTY		8,700	Total	Vacant	Workers	%	Workers	%	Persons	Persons
Noxon/Heron area	13	1,400	750	240	70	39%	30	36%	146	80
Trout Creek area	19	1,300	500	60	25	14%	15	18%	51	40
rural Thompson Falls	35	400	260	90	15	9%	8	10%	32	22
Thompson Falls	39	1,500	700	60	15	9%	5	5%	32	12
Plains area	65	1,100	500	75	0	0%	0	0%	0	0
study area subtotal[1]		5,700	2,700	530	125	70%	58	70%	261	155
BONNER COUNTY, IDAHO		27,000								
Clark Fork area	32	600	350	80	15	8%	8	9%	31	21
Hope area	42	400	260	100	6	4%	4	4%	13	10
Sandpoint area	57	8,000	4,900	1,800	15	8%	6	7%	31	16
study area subtotal[1]		9,000	5,500	2,000	36	20%	21	21%	75	47
LINCOLN COUNTY		18,000								
western Lincoln County	46	1,300	600	100	7	4%	3	4%	14	9
Troy area	49	1,200	500	160	7	4%	3	4%	14	8
Libby area	61	3,300	1,600	330	5	3%	1	1%	11	2
study area subtotal[1]		5,800	2,700	600	19	10%	7	9%	39	20
3 COUNTY POPULATION[1]		53,700								
TOTAL STUDY AREA[1]		20,500	10,900	3,100	180	100%	84	100%	375	222

Source: ASARCO, Incorporated 1987-1994; U.S. Bureau of Census 1993.

Note: [1] Population estimates for study areas of each county do not add up to the total county population.
[2] Housing stock includes all seasonal and permanent housing, including housing for rent, for sale or vacant.
[3] Family and population figures include immigrating mine employees and other workers who immigrate to take derivative employment induced by the project. Construction estimates are for the peak construction employment.

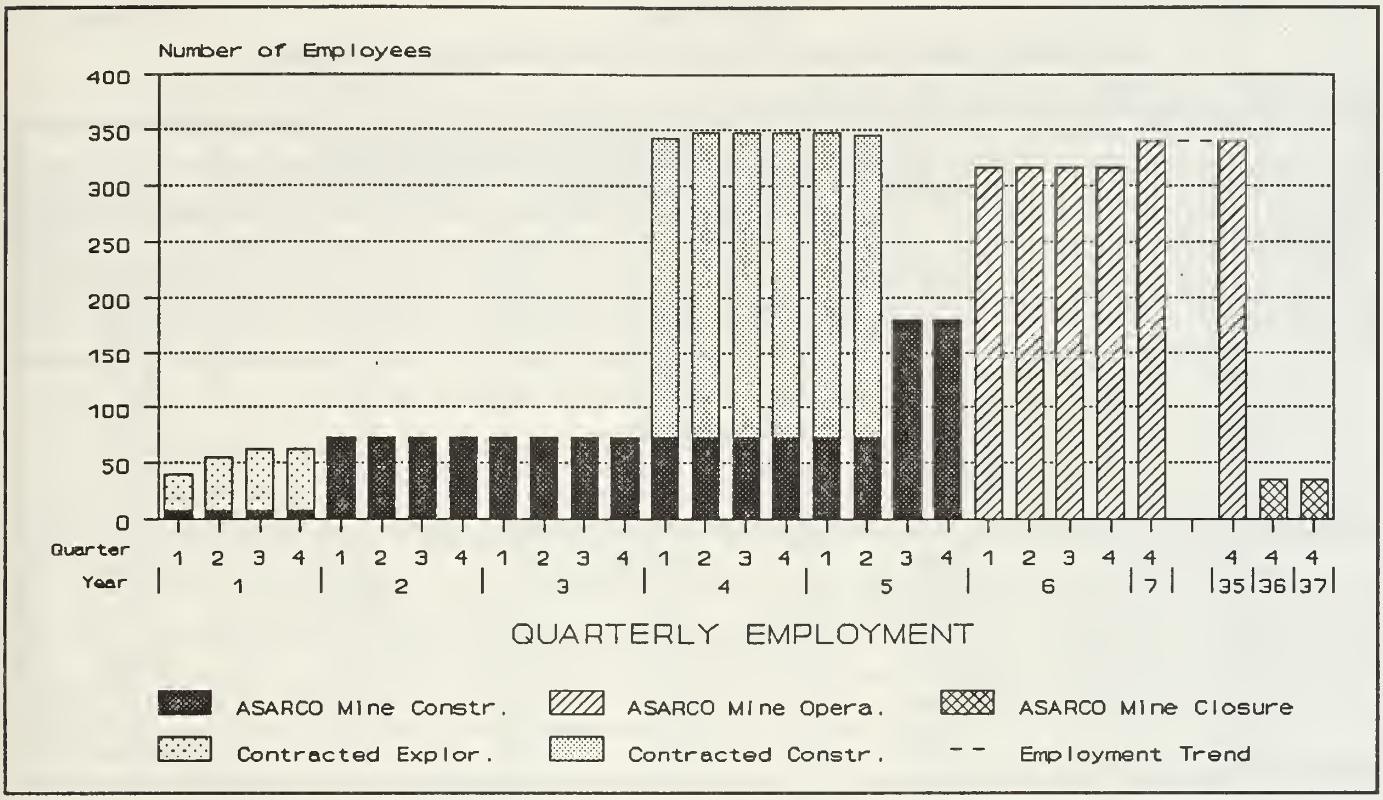


Figure 4-4. Alternative IV Employment

Source: ASARCO, Incorporated.

Land Use

Grizzly bear mitigations would impact only about 2,303 acres of private land under Alternative IV due to the mill site relocation.

Cumulative Effects

Cumulative impacts are similar for all action alternatives. The Montanore Project combined with the Rock Creek Project would result in slightly increased area populations, noticeable only in the Troy area, as a result of mine worker immigration (see **Table 4-37**).

Employment at the Montanore Mine, located 18 miles south of Libby, would peak at 530 workers during an estimated 3-year construction period. Then, 450 mine operations workers would be employed for a period of 15 years. None of the Montanore operations workers are expected to reside in Sanders County, but an estimated 10 percent (8 workers) from the immigrating Rock Creek mine work force would be expected to reside in Lincoln County (see **Table 4-37**). The project would be expected to cause an immigration of 20 to 25 persons (0.1 percent) into Lincoln County from 2000 to 2015, a minor cumulative socioeconomic impact.

TABLE 4-37.
Cumulative Mine Projects Population and Immigration Impacts

Year	Projected base population	Projected Population Immigration		Total
		Rock Creek Project	Montanore Project	
Sanders County				
1995	9,000	0	0	9,000
2000	9,410	237	0	9,647
2005	9,700	158	0	9,858
2015	10,050	158	0	10,208
2015	10,170	158	0	10,328
Lincoln County				
1995	17,600	0	0	17,600
2000	17,800	22	319	18,141
2005	18,100	22	319	18,441
2010	18,400	22	319	18,741
2015	18,900	22	0	18,922

Adapted from Montanore Final EIS 1992.

The two mine projects could compete for highly skilled local mine workers. The ASARCO and Noranda training programs and the currently unemployed in Lincoln and Sanders counties could provide a sufficient pool of skilled workers. Therefore, the 80 percent local hiring goal for both projects is feasible even if both mines were to begin operation simultaneously.

TRANSPORTATION

The action alternatives would affect between 16 and 22 miles of existing National Forest roads. Traffic patterns, safety, and volumes would be affected to a greater or lesser degree for all action alternatives. Traffic on Montana Highway 200 would increase from about 30 to 36 percent over 1993 traffic volumes. Traffic volumes on the National Forest transportation system within the affected area would increase by 2,300 to 2,800 percent. Soils and vegetation disturbance would range between 33 to 65 acres, and 43 to 82 acres, respectively, for the action alternatives.

Impacts associated with access to alternative rail load-outs differ: the ore concentrate trucks would operate on Montana Highway 200 and FDR No. 150 for Alternative II and operate only on FDR nos. 150 and 150B for alternatives III and IV. Under alternatives III and IV, traffic safety would be increased and user conflicts on Montana Highway 200 would be reduced.

Introduction

Acreages discussed in this section are only those impacted by the main roads; utility corridors and associated project maintenance roads are considered elsewhere in this EIS (see Soils). Some assumptions were used in number of occupants per vehicle and approximate clearing and soil disturbance acreage per mile. Typical per mile disturbance acreage for soils and vegetation is shown on **Table 4-38.** Typical acreages for double-lane roads apply to FDR nos. 150 and 2741, and the mine portal access roads. Portions of the utility and pipeline corridors that parallel FDR No. 150 would require a right-of-way width 30 feet wider than proposed clearing width as shown in **Table 4-38.** This additional disturbance is discussed under Soils and Reclamation.

TABLE 4-38.
Soil and Vegetation Disturbance for Roads

	Average Width (ft)	Double-lane Road		Average Width (ft)	Single-lane Road	
		Construct[1]	Reconst[2]		Construct[1]	Reconst[2]
SOILS	54	6.5	4.0	29	3.5	*
CLEARING	70	8.5	5.5	37	4.5	*

Note: [1] Acres per mile
[2] Small variable amounts to add needed turnouts or to provide better sight distance.

Plans were already in existence for planned reconstruction of segments of Montana Highway 200 prior to this mine proposal. Existing FDR No. 150 and its bridges would need to be rerouted and reconstructed to handle the increased traffic efficiently and safely.

Alternative I

Future Forest Service ecosystem management activities such as wildlife burns, timber sales, and other activities would cause short-term (from less than a week to 2 to 3 years) increases in traffic volume and pattern. These activities are not sufficient in size to require FDR No. 150 to be upgraded to a double-lane road. There are no current plans for capital improvements to the roads or bridges for forest activities. Road maintenance could be expected to remain at current levels. Road cut-and-fill slopes are mostly stabilized and revegetated. There are small areas that have not revegetated due to soil type, slopes, aspect or past borrow material removal. These areas are small and contribute little to any sedimentation.

Alternative II

Road Construction/Reconstruction

Under Alternative II, 7,100 feet of new road diverging from Montana Highway 200, and an additional 5,900 feet of road around the mill site would be constructed along the FDR No. 150. Neither route was field located; maps were drawn for approximate location by ASARCO. This alternative has 4-plus miles of construction and about 5.3 miles of reconstruction. **Table 4-39** shows approximate disturbance by alternative for all transportation corridors.

TABLE 4-39.
Approximate Disturbed Acres per Alternative
(for Access, Adit, Railroads, and Rail Siding)

	Action Alternatives		
	II	III	IV
Acres of Soil Disturbance[1]	19	30	20
Construction			
	23	35	13
Reconstruction			
Total Acres of Soil Disturbance	**42**	**65**	**33**
Acres of Vegetation Clearing	25	38	25
Construction			
Reconstruction	31	44	18
Total Acres Cleared	**56**	**82**	**43**

Note: [1]Soil disturbance acres are included in the acres of vegetation clearing.
Figures based on the assumption that the existing road occupies 2.5 acres/mile that would be fully disturbed during construction.

The proposed new segment of FDR No. 150 would cross some unstable soils in the vicinity of Montana Highway 200. The magnitude of unstable soils in this area is unknown, but construction of the road in these soils would increase costs associated with soils stabilization. The approach to Montana Highway 200 does not meet MDT's requirements for sight distance.

Three bridges on FDR No. 150 would need to be constructed over Rock Creek; one new and two replacements. The new bridge would cross Rock Creek somewhere in the vicinity of milepost 2 on existing FDR No. 150. This general area of the creek has a large 200- to 300-foot floodplain with some braided channels. The horizontal alignment of the existing road may require the new bridge to be skewed to the drainage, thus increasing the bridge length and the associated southern approach to the bridge. This skewed approach renders the bridge more susceptible to washout during flooding because more bridge is exposed to flow and more piers are needed for support. Also, since the approach would be built at an angle to the creek, corners would be exposed to erosion or washout.

The two bridge replacements would be installed in their existing locations over Rock Creek (mileposts 2.3 and 5.0), moving slightly up- or downstream to accommodate the road's horizontal alignment. A detour bridge would be necessary to accommodate traffic during replacement activities. This detour bridge would have to accommodate not only passenger cars, but trucks up to 40-ton gross vehicle weight; two side-by-side bridge crossings and associated clearings. This would increase the potential for sedimentation in Rock Creek. A short addition to the 6-foot-diameter culvert on the West Fork of Rock Creek near its confluence with the East Fork would be required.

Road reconstruction designs would use as much of the existing road alignment as possible. Any remaining road segments would be obliterated and revegetated. Cleared acreage would remain essentially treeless as long as the road was needed. Disturbed soils would be susceptible to erosion during, and up to 2 years after, earthwork. However, sediment movement into stream courses would be minimized using erosion-control techniques along or when crossing streams, and by using BMPs in road design and construction.

The mine adit access road would be about 8,800 feet long. Its mapped location crosses slopes ranging from level to 60-plus percent. The elevation difference between the mill site and adit would be about 580 feet. This elevation change would require a minimum of a 9-plus percent sustained grade for the entire road. This long, steep grade would require numerous surface water deflections to channel surface water runoff off the traveled way. Construction of this road segment could generate up to 60,000-plus cubic yards of soil and rock for road building and turnouts. On slopes over 55 percent, the roadway would be built entirely on the excavated (cut) side of the slope and not on the embankment (fill) side. This is because fill would not adhere to steep side slopes. Residual fill material could either be cast over the roadside or hauled to another location. Impacts associated with construction of the adit access road include high probability of either the bank sloughing and/or road slumping. Secondary impacts would include large visible roadcuts, removal of old growth timber and habitat, and increased possibility of sedimentation to Rock Creek.

Aggregate Source. It is estimated that upwards of 50,000 cubic yards of aggregate would be needed for road construction and reconstruction. The tailings impoundment starter dam borrow areas may provide a source of aggregate (gravel) for road construction and reconstruction. However, this source has not been investigated for this use, the material has not been tested for quality, hardness, and durability, and its quantity is unknown. Any aggregate material must be tested and must meet minimum/maximum Forest Service standards prior to use for roads. An additional source of aggregate would be exploration adit waste rock. ASARCO has indicated that they would use this material if insufficient or unsuitable material was in the borrow areas (Dave Young, ASARCO Incorporated, personal communication to Richard Stearns, June 22, 1994). Use of the exploration adit waste rock could significantly reduce the size of the waste rock dump.

There are two partially developed existing aggregate sources on NFS lands within the project area. One is adjacent to the solid waste transfer site just west of the tailings impoundment area and the other is located at about milepost 2 on FDR No. 150, northeast of the impoundment area. Neither source has been explored to determine if sufficient quantity would be available. If ASARCO decided to use these sources, acreage disturbances would be increased approximately 5 acres and ASARCO would be required to reclaim the pits according to a Forest Service Mineral Material Permit.

If common source borrow areas on NFS lands were needed outside of the proposed borrow areas, a pit survey and subsurface exploration would be necessary to determine quantity, and pit development and restoration needs. Impacts associated with this activity would be analyzed in an additional NEPA document.

Rail Load-out

The Hereford rail siding is located 3.5 miles northwest of Noxon, adjacent to Montana Highway 200 and Montana Rail Link track on private land. Access from the highway to the tracks is provided by about 0.25 mile of county road. A new highway intersection would not be needed as there is adequate sight distance. There would be about eight ore trucks over a 24-hour day traveling 6 miles from the load-out to the intersection with FDR No. 150 on Montana Highway 200. The concentrated ore that would be shipped by truck and rail is not considered a hazardous material under current hazardous material classification (Dave Young, ASARCO, Incorporated, personal communication to Paul Kaiser, April 20, 1994).

The additional activity at the rail siding would increase noise levels affecting residents living near the siding (see Sound). There would be an increased potential for accidents due to the slower speeds of the ore trucks on Montana Highway 200 and their turning onto and off the highway at both the rail siding and FDR No. 150.

The existing rail siding may need some improvements to handle the ore cars. A cost estimate of $144,000 was developed for these improvements (Jay Lentzner, Montana Rail Link, personal communication, October 13, 1993, November 15, 1993, and letter February 14, 1994).

Traffic Volumes

Traffic volumes and patterns would be the same for all action alternatives for FDR No. 150. During the construction phase, about 400 workers would travel to the mill/mine site daily. There would be about 50 service/supply trucks delivering construction materials daily. This combined traffic would result in a potential 450 round trips on the road, or 900 average daily traffic (ADT). This would last about 4 years. The start-up and termination phases of construction would not generate this much traffic, however. During the operation phase, there would be about 355 employees making up a three-shift per day, 7-day week. Three shifts per day would generate a maximum of 355 round trips per day, or 710 ADT. Along with service, delivery, and trucks hauling concentrate, the total traffic from mine operation would be 740 ADT.

Traffic during both the construction and operational phases would increase traffic volume on state highways leading to the mill entrance road. This increase in traffic would be greatest on Montana Highway 200. Using the maximum ADT for the construction phase would place a 71 percent increase in traffic on Montana Highway 200. This increase would be an unknown split between west- and eastbound traffic on Montana Highway 200. MDT has no current plans to upgrade or reconstruct any highways affected by this proposed traffic increase.

FDR No. 150 would experience a 2,800 percent increase in traffic during construction, from 33 to 933 ADT, assuming the recreation traffic would remain the same. During the operational phase, traffic would amount to 740 ADT including delivery and ore truck trips. This increase would amount to a 30 percent increase in ADT for Montana Highway 200. On FDR No. 150, this would be a 2,300 percent increase in ADT. A double-lane road is necessary to handle this traffic. ASARCO has stated that they would encourage carpooling to minimize the impact on road use (Dave Young, ASARCO, Incorporated, letter to Paul Kaiser, September 17, 1993). However, past experience with carpooling at the Troy Mine did not meet with great success.

The traffic pattern during the construction phase would be heaviest in the early morning and late afternoon, with the potential for some traffic any time during the day or night. During the 30-year operation phase, traffic would be greatest just before and after a shift change, and then during normal office business hours for management, clerical, and maintenance personnel. Shift change hours have not been established at this time. Increases in early morning and late afternoon traffic would increase the risk of vehicle-wildlife accidents on both FDR No. 150 and Montana Highway 200 (see Biodiversity and Threatened and Endangered Species).

Truck traffic associated with the rail load-out would generate 16 ADT, adding a little over 1 percent to the existing traffic. It would be less than 1 percent when the ADT for the mine workers is taken into account. This truck traffic would drive over 35,000 miles a year on Montana Highway 200.

Traffic accidents would increase in direct proportion to increased traffic. KNF has no accident data for FDRs in the project area. Users tend to increase vehicle speeds on improved roads beyond design standards; this could increase the potential for traffic accidents on FDR 150. Users on Montana Highway 200 would also have an increased risk of traffic accidents due to the increase in traffic volumes.

Traffic Management

A road surface would need to be maintained for traffic movement on FDR No. 150 during road construction and reconstruction for passenger cars and delivery trucks. ASARCO would need to develop a traffic plan to allow private landowners reasonable access to their property, and public access to National Forest lands. In addition, emergency medical evacuation would need to be considered in the plan for workers at the mill or mine site. During reconstruction of the FDR No. 150, and to some extent FDR No. 2741, a 30 minute delay could be anticipated. This delay could happen at any time or along any road segment being reconstructed.

When a road was being reconstructed, the road surface would be usable with a passenger vehicle during non-work periods (evening and weekends). Signing would conform to Manual of Uniform Traffic Control Devices. Any closure of FDR No. 150 due to construction activities would be posted at the beginning of the road and public notification made in a local paper.

Road Maintenance

The maintenance of roads used by ASARCO for mine operation, by the public, and Forest Service administrative and commercial traffic, would be prorated commensurate with use by each party. The Forest Service would be responsible for all public recreation traffic and Forest Service administrative and commercial traffic. ASARCO would be responsible for all employee traffic, freight- and concentrate-truck traffic, and other traffic associated with operation of the mine. Those road(s) used solely by ASARCO would be ASARCO responsibility. A Commercial Road Use Permit issued by KNF must spell out the type, amount, and frequency of maintenance. The increased amount of maintenance by ASARCO would keep FDR No. 150 open to the public year-round, resulting in increased recreational traffic and activities and indirect impacts to other resources (see Recreation, Biodiversity, Threatened and Endangered Species, and Wilderness).

Alternative III

Road Construction/Reconstruction

This alternative changes the location of the Montana Highway 200-FDR No. 150 intersection and has about 3.4 miles of construction and about 4.6 miles of reconstruction (see **Table 4-39**). Soil would be disturbed on about 65 acres; 30 acres for construction and 35 acres for reconstruction. Necessary clearing would amount to about 82 acres; 38 acres for the construction segment (8.5 acres per mile) and 44 acres for reconstruction (5.5 acres per mile).

Two bridges are necessary for this route; a new one over Engle Creek and a replacement at milepost 5.0 on FDR No. 150 over Rock Creek. The bridge across Engle Creek has advantages over the Alternative II proposal due to road alignment, length of bridge, length of road in floodplain, stream channel stability resulting in less erosion potential, and associated cost savings. The construction segment of the route has been reconnoitered from just above the Engle Creek crossing to Montana Highway 200. The road would be situated on a flat-to-moderately-sloped bench above the floodplain. The reconstruction segment would use as much of the existing road as possible. Any unused portion would be obliterated and revegetated according to an Agency-modified reclamation plan (see Chapter 2, and Soils and Reclamation, Chapter 4).

A third existing treated timber bridge over Rock Creek at milepost 2.3 would need to be replaced. Additional soil disturbance of about 0.02 acres would result from the bridge replacement. Although this acreage is small, it is immediately adjacent to Rock Creek. The impacts associated with bridge replacement can be mitigated by required BMPs in the contract, and timing construction during normal low water flows. No detour bridge would be required because this bridge would be constructed after relocated FDR No. 150 was passable.

The mine portal access road changes with this alternative. Existing FDR nos. 150 and 2741, and a 1,200-foot spur road to the mine adit would be reconstructed to double-lane standards. Soil and rock disturbance for this route would total an additional 17 or so acres over its 1.7 mile length. Clearing would total about 19 additional acres for this route. No bridges or major culverts (78-inch diameter and larger) are anticipated for this route. This would eliminate potential slumping and erosion of the steep slopes between the mine portal and the mill sites associated with ASARCO's proposed mine adit access road. Impacts to old growth habitat are also reduced (see Biodiversity).

Trucks hauling waste rock from the mine to the waste rock dump would use the 1,200-foot spur road and a new 1,700-foot waste dump road, at the upper edge of both dumps, paralleling FDR No. 2741. This would disturb about 5 acres of soil and rock, and require 6 acres of clearing. These roads would accommodate only mine traffic.

A 0.25 mile of road would be constructed to tie FDR No. 1022 (McKay Creek Road) to the new FDR No. 150 to access Montana Highway 200 (see **Figure 2-22**). The existing highway intersection for FDR No. 1022 would be obliterated. This short stretch of new gravel road would be constructed to single-lane standards with turnouts. About 1 acre of soil would be disturbed and 1 acre of clearing necessary. This would consolidate two FDR road intersections with Montana Highway 200 and would improve traffic safety along the highway.

Miller Gulch Rail Siding

The rail load-out would be located northwest of the solid waste transfer site (see **Figure 2-22**). The rail load-out and rail construction site would disturb about 2 acres of soil and require 2.5 acres of vegetation clearing.

The Miller Gulch rail load-out access road, tailings dam road, and public roads would be single-lane with turnouts. All roads would be paved. The rail siding would necessitate construction of about 0.3 miles of new road, 1.5 acres of soil disturbance and 1.7 acres of vegetation clearing. Additional disturbances would be associated with the tailings dam road (included in the tailings impoundment disturbance acreage). About 0.05 acres of additional disturbance would be required for turnouts.

ASARCO haul trucks, maintenance and administrative vehicles, and Agency administrative vehicles would use about 3 miles of existing or relocated FDR No. 150B. FDR No. 150B begins at a junction with FDR No. 150 near Engle Creek continues to its junction with Government Mountain Road west of the tailings impoundment (see **Figure 2-22**).

Traffic Volumes

Total traffic on FDR No. 150 above the mill site and FDR No. 2741 would probably be low compared to the access road to the mill site. No estimate of ADT was completed on this segment. The public would be able to use about the first 1.4 miles of this route for recreation access. Mine and maintenance workers would use this road, and an occasional piece of heavy mine equipment could be moved from the mine to the equipment maintenance building for repairs. It can be assumed that all miners would use the main parking area and be shuttled to the mine adit as parking at the adit would be very limited. The majority of traffic would occur during shift changes, with some traffic likely during any hour of the day or night. If ASARCO chose a two-shift operation, the traffic would potentially decrease by about one-third, due to the elimination of traffic associated with the third shift.

Carpooling could be used to increase auto occupancy from 1 to 1.5, thereby decreasing ADT for FDR No. 150 by 33 percent; from 800 to 536 ADT during the construction phase, and from 710 to 475 ADT during the operational phase. The service, delivery, and concentrate truck ADT cannot be reduced.

The ADT on FDR No. 150B, except for the county road, and the rail load-out access road would be approximately 25. No estimate was made for the county road.

An indirect beneficial effect of the Miller Gulch load-out would be the elimination of concentrate truck traffic on Montana Highway 200. This would mitigate some public concerns over vehicle safety of truck traffic on the highway. There would be about a 35,000-mile-per-year reduction in truck mileage compared to the Hereford load-out. An additional indirect beneficial impact would be the energy/fuel savings that would result from this travel reduction.

Traffic Management

FDR No. 150B would be signed to restrict public travel. The rail siding access road would be limited to ASARCO and Montana Rail Link vehicles and signed to discourage public use.

Upon mine closure, the Forest Service with input from ASARCO would determine roads to be retained and their respective levels of service. Roads not necessary to meet public needs would be removed and reclaimed by ASARCO.

Alternative IV

Road Construction/Reconstruction

The change in mill location would result in an 30,700-feet (5.8 mile) road length for all roads needed to implement Alternative IV. The mill-access-road, from State Highway 200 to mill site entrance, length for FDR No. 150 is 26,800-feet (5.1 miles). This would result in a reduction of total acres disturbed (see **Table 4-39**). The existing FDR No. 150 alignment from the mill site entrance to the heavy equipment adit portal access road entrance would be used to route the non-mining traffic around the main mill site, and to FDR No. 150A. This route would be about 1900-feet long and would be a double lane, aggregate surfaced road. From the heavy equipment portal access road to the mill site's upper boundary the road would revert to a single- lane road. This 400 feet of road would need reconstruction to a transition segment from a double-lane to single-lane road. An additional adit portal access road for heavy equipment of about 400-feet (0.08 mile) would need to be constructed from FDR No. 150 to the portal site.

In addition to the three bridges (crossing Rock and Engle creeks) required for this alternative, an overpass structure would be needed to allow an underpass road for mine adit access by workers and small equipment, and for the ore conveyor belt. This would require the existing vertical alignment on FDR No. 150 to be modified, allowing for a lesser grade on the bridge overpass than exists on the current road. A maximum of 4-percent grade is desirable for the overpass structure. This overpass grade would cause a small increase in approach grades to the structure. The difference in elevations from finished grade FDR No. 150 to finished grade adit access road would be about 20-feet. Building the overpass would avoid the need to relocate FDR No. 150 around the mill site and would help retain a vegetative buffer between the road and mill site. This would, in turn, help reduce sediment loading to surface waters and reduce visual impacts.

Traffic Volumes

Traffic volume for Alternative IV would be similar to Alternative III except that mine-related traffic above the confluence would be limited to exploration and maintenance-related activities. Most mine traffic would be able to access the mine adit from the mill site without entering or crossing FDR No. 150. However, a mix of public, mine and Forest Service traffic would occur between the mill site entrance and the heavy equipment adit portal access road entrance on FDR No. 150. This segment of road would be used primarily for movement of heavy equipment from the adit portal to the mill site for maintenance. Those pieces of equipment that were too wide or tall to use the overpass route would use the secondary access route to the adit portal. Double-lane design and proper signing would mitigate traffic conflicts on this segment.

Cumulative Impacts

The impacts of mine traffic and road construction when combined with the effects of timber harvest and recreational activities would result in 1) cumulative increases in traffic on Montana Highway 200 and FDR nos. 150 and 2741, 2) the potential for increased indirect effects of sediment and erosion, dust, noise, wildlife stress and road-kill, and impacts to old growth, and 3) a slight increase in traffic safety hazard on roads associated with the project. Increased traffic associated with the rail load-out would mix residential with other rail-associated traffic at the Hereford load-out. Mine traffic accessing the Miller Gulch rail load-out would mix with residential and logging traffic.

Future Forest Service ecosystem management activities that would increase the open road density may require closure of some existing open roads within BMUs during mine operation. Roads to be restricted would depend on the activity needs at that time (see Threatened and Endangered Species).

RECREATION

Summary

For the action alternatives, most recreational vehicle access in the Rock Creek drainage would continue. Foot and vehicle traffic at the mill site, portals, and tailings impoundment would be restricted. Between 4 and 4.5 miles of road would be closed to motorized vehicular access to mitigate impacts to wildlife.

Local population growth would likely increase recreational use in the area. Increased activity in the Rock Creek drainage could reduce the quality of hunting in the drainage if game populations were displaced.

Recreational use would be modified by changes in access, number of users, and lands available for use. Recreational activities which could be affected by any of the action alternatives include hunting, fishing, camping, berry picking, recreational driving, and other related activities.

Alternative I

Recreational opportunities and use levels, patterns, and growth trends would be expected to continue as they now occur or as may be altered by future management activities. Use levels are increasing annually by 1 to 3 percent.

Alternative II

General Access

Most roads currently open to recreational vehicle traffic would remain open, or would be rerouted to provide similar access, throughout the mine life. However, 4.4 miles of road would be closed to restrict motorized use (while still allowing nonmotorized use) to compensate for mine-related impacts to the grizzly bear. Closures would include 2.5 miles at the upper end of Chicago Peak Road (FDR No. 2741) and the upper 1.9 miles of Orr Gulch Road (FDR No. 2285). Access on open roads would be temporarily impacted by the delays and increased traffic during the construction phase of the project (see Transportation). Mine-related and recreational road use would be mixed for about 6 miles on FDR No. 150.

Public access would be restricted on approximately 500 acres in the immediate vicinity of the mill site, mine portal site, and tailings impoundment. This may alter recreational travel patterns and access routes to adjacent areas. Popular huckleberry-picking spots within the mill site would become unavailable.

Road closures would tend to concentrate motorized recreational pursuits to a slightly smaller area, but would increase opportunities for nonmotorized recreational activities. Access to popular sites such as Chicago Peak or Engle lakes would be more difficult because of road closures. Recreational use in areas closed to motor vehicles would decrease slightly. After mining ceased and reclamation was complete, the need for continued closure of roads would be reviewed. Need for continued closures would be dependent on the existing conditions for the grizzly bear and other wildlife at the time. It is likely that roads closed at the beginning of the project would become overgrown and would not be reopened after reclamation.

Hunting, Trapping, and Fishing

Public access restrictions in the vicinity of the mine portals, mill site, and tailing impoundment site would reduce available hunting areas, altering some individuals' hunting schemes. ASARCO would prohibit possession of firearms and hunting within their private lands where hunting has occurred in the past. Some commonly used hunting camp locations would become unavailable or undesirable for campsites. On the other hand, paving and plowing of FDR No. 150 might improve general access for hunting and fishing.

Local population growth would likely result in increased fishing, hunting, and trapping in the study area. Increased use of the area could eventually reduce the quality of trapping, thus eventually reducing trapping. Mine employees who hunt could be expected to spend more of their time hunting in the Rock Creek drainage than in other areas because of their necessary access for work.

Because of increased populations and the potential for increased hunting in the Rock Creek drainage, competition between commercial outfitting and the general public could increase. This may decrease the quality of the hunting experience and opportunity for a successful hunt. Some of the commercial hunting activities that currently occur in the Rock Creek drainage may be relocated to other areas within the recreation study area. This would not have a noticeable effect on hunting in the study area.

Increased activity in the Rock Creek drainage may cause some game species to relocate within or out of the drainage (see Wildlife). This movement of animals, along with the potential increased number of hunters, could reduce the quality of the hunting in the drainage. New residents would likely follow the current fishing patterns of local residents. The majority of fishing activity would occur on the Noxon and Cabinet Gorge reservoirs and wilderness lakes that have fish (neither Copper nor Cliff lakes have a fishery). Increased fishing pressure may slightly reduce fish populations.

Recreation Setting

The Forest Service currently classifies the study area's recreational setting as "Roaded Natural". Development of the mine would be more consistent with a "Roaded Modified" classification within the Rock Creek drainage due to the dominating visual modification associated with the mine. The rest of the recreation study area would remain unchanged.

Alternative III

General Access

All impacts would remain the same as under Alternative II with the following exceptions. Mine-related and recreation activities would be mixed for about 8.5 miles on FDR nos. 150 and 2741. Recreationists using the Chicago Peak Road (FDR No. 2741) would share it with periodic heavy equipment use (see Transportation). Recreational travelers could experience delays, limited roadside parking, and increased risk of collisions because of shared use with mine-related traffic from the mill site to the mine portal turnoff. Access to some locally favorite huckleberry picking sites would become less convenient because of heavy mine use of the Chicago Peak Road. Public access would be restricted on 520 acres.

Motor vehicle use would be restricted on 4.5 miles of roads to compensate for mine-related impacts to grizzly bears. Closures would be restricted on 2.5 miles of the upper end of Chicago Peak Road, and 2.0 miles on the upper end of Orr Gulch Road, reducing impacts as compared to Alternative II, for people accessing the wilderness. Other road closures would remain the same.

Alternative IV

General Access

Impacts would remain the same as Alternative III except as follows. Public access would be restricted on approximately 475 acres. Heavily used camping sites near the proposed mill site would become less popular for recreational use. Few huckleberry picking sites would be affected.

Mine-related and recreation traffic would be mixed along approximately 5 miles of FDR No. 150 below the mill site. Road closures restricting motorized access would be the same as Alternative III.

Cumulative Effects

Cumulatively, access could increase in the area if additional roads were built for timber harvest. These roads would be restricted to nonmotorized access after timber harvest. Recreational use could increase as local populations increased.

The quality of hunting and trapping would be affected by both timber and mineral activities and the potential increase in the number of hunters and trappers. Timber harvesting might displace big game to other areas within and/or out of the Rock Creek drainage. This movement of animals could reduce the quality of the hunting experience and the likelihood of a successful hunt. Once harvest activities were terminated, game could be expected to return to the areas.

WILDERNESS

Summary

Under the No-Action Alternative, use of the CMW would be expected to increase as projected in the Forest Plan. The impacts associated with this proposal would not occur.

Under the action alternatives, mine-related activities outside the CMW would likely be heard, seen, or smelled from some locations within the CMW. The proposed ventilation adit within the wilderness boundary could be noticeable to some wilderness visitors and more visible but less audible *under alternatives III and IV than under Alternative II. Alternatives III and IV would be less noticeable than Alternative II after reclamation.*

Introduction

The Wilderness Act directs the Forest Service to protect the natural character of wilderness and to provide for recreational, scenic, scientific, educational, cultural, and historical uses of wilderness areas. The four requisite attributes of wilderness are:

1) Natural integrity: the extent to which human influences alter natural processes by comparing the condition of the area to its probable condition without human impacts.

2) Apparent naturalness: closely related to natural integrity. Both qualities may be altered by the same activities. Apparent naturalness focuses on how the activities are perceived by the general public. They include impacts that are seen, heard, or smelled.

3) Solitude: isolation from the evidence and presence of other humans. Features that contribute to solitude include size of area and distance from perimeter to center. Vegetation and topographic screening are also related to solitude.

4) Primitive recreation: provides opportunities for isolation from the evidence of humans. Visitors feel they are a part of the natural environment. They may enjoy a high degree of challenge and risk, and use of outdoor skills.

The Forest Service also describes additional wilderness attributes of outstanding ecological, geological, scenic, and historical features. Ecological features include threatened or endangered species of animals and plants and old growth vegetation. Geological features offer landforms that represent significant examples of geological processes. Scenic values are based on significant scenic qualities of the natural landscape in the wilderness. The quality of these natural features depends on how unusual, outstanding, and uncommon the natural features are in the landscape of the geographic region. Cultural and historical features comprise all evidence of historic and prehistoric human use of an area.

Alternative I

Use and character of the CMW would probably continue as projected in the Forest Plan.

Alternative II

Natural Integrity

The only surface structure proposed within the wilderness is the ventilation adit. This adit would be located on a north-facing aspect, on an estimated 60 percent slope, that supports little vegetation. The adit would occur in goat summer/transition range and would disturb about 3,000 square feet of surface area.

There would be a relatively small, localized increase in particulate pollutants at the proposed mill site and tailing impoundment site resulting from the project. Wind erosion of tailings may occur under extremely windy conditions. The potential exists for these pollutants to reach the CMW Class 1 airshed. However, air pollution levels in all areas are expected to remain well below state and federal ambient air quality standards (see Air Quality).

Potential subsidence could cause topographic changes to the surface (see Geology and Hydrology). The 404(b)(1) permit would require a contingency plan to be implemented if any surface waters were affected.

Displacement of some wildlife species from areas disturbed by mining activities could increase some wildlife populations within the CMW. Isolated areas of habitat within the CMW could be altered and/or stressed by increased use (see Biodiversity).

Certain natural processes within the CMW may be altered. These would include potential impacts to goats and grizzly bears and short-term displacement of other wildlife and related impacts on habitat. Wildlife and their habitat are primarily influenced by weather, topography, elevation, and other natural factors but mining-related disturbances could adversely affect natural processes of selected species. Overall, however, the wilderness would largely retain its existing character provided subsidence did not occur.

Apparent Naturalness

The ventilation adit, the grate across the adit opening, or site disturbance associated with construction of the adit may be visible from some locations in the East Fork Bull River drainage. However, any of the locations where the adit would be visible are in rugged terrain, generally inaccessible, and are not on popular routes or at destinations generally used by wilderness visitors. Therefore, for most wilderness visitors, the adit would not change the apparent naturalness of the wilderness. Although the adit would continue to exist after the life of the mine operations, reclamation procedures would close the opening and make it much less apparent than during operations.

Some wilderness visitors could feel that the naturalness of the CMW was adversely affected by the knowledge that the ventilation adit and underground mine existed within the wilderness boundary. This could be considered an emotional violation of apparent naturalness.

The tailings impoundment site, portions of the transportation and utility corridors, and a small part of the mill site could be seen from some locations within the wilderness (see Scenic Resources). These facilities would reduce the apparent naturalness of lands outside the wilderness, but would not visually change the apparent naturalness of designated wilderness lands.

Mine-related noises that could be heard in the wilderness include noise from construction, the ventilation adit, underground blasting, and activities at the exploration adit (0.25 mile away). Sounds from the mill site (1.0 mile away) and motorized equipment associated with the mine also could be heard from some locations within the wilderness. Magnitude of these noises is dependent on location of the sound and the wilderness visitor, and weather conditions (see Sound). Mine-related noise would reduce the apparent naturalness of the wilderness for visitors, primarily in the Chicago Peak vicinity and near the ventilation adit. However, human-caused noises (such as vehicles and trains) can already be heard from many locations in the wilderness, moderating this impact.

No mine-related sounds are expected to be audible from the wilderness lakes most often visited by wilderness users. This includes Rock, Saint Paul, and Moran lakes. Therefore, the apparent naturalness of those areas would not be affected by mine-related noise.

Although air pollution levels are expected to remain well below ambient air quality standards, the presence of air pollutants may be evident to some wilderness visitors on a short-term and intermittent basis (see Air Quality). Pollution levels high enough to be noticed are expected to be very localized and intermittent. Evidence of such pollutants would depend on such factors as 1) the type and amount of pollution, 2) wind speed and direction, and 3) the location of the visitor. Evidence of pollutants noticed would decrease with distance from the source. If the pollutants were noticed, they would reduce the apparent naturalness of the wilderness. Generation and evidence of air pollution would cease after final reclamation.

Solitude/Primitive Recreation

Opportunities to see, hear, or otherwise notice mine-related activities would exist from some locations within the wilderness. This would reduce the opportunity to experience solitude or enjoy a primitive recreation experience at those locations as compared to the current situation.

The proposed project would bring about 230 additional residents into the area during the life of the mine. Assuming that each additional resident would visit the CMW at least once a year, recreation wilderness visit would increase 3 percent over current use. These people would be expected to follow wilderness use patterns of the other local residents. Their activities would occur predominantly at the lakes that support fishing and on the trails leading to those lakes. Some of these people could be expected to stay in the area and use the wilderness after the mine closed. Opportunities for solitude would decrease to a minor degree. However, opportunities for solitude from other humans would increase slightly at Chicago Peak and Engle lakes because road closures (4.5 miles) on Chicago Peak and Orr Gulch roads would reduce accessibility to trails leading to those areas.

Impacts from human activities are currently apparent at most of the popular destinations in the wilderness. These impacts primarily consist of site disturbance and litter from day use visitors and campers. Impacts from increased local population use are not expected to be substantially different in kind or amount from existing impacts. Therefore, the apparent naturalness or primitive recreation activities would be minimally affected.

Impacts to solitude/primitive recreation under Alternative II would be potentially significant in the vicinity of ventilation adit.

Ecological, Geological, Scenic, and Historical Features

Mine-related impacts would not alter the historical features within the wilderness. However, ecological, geological, and scenic, features would be modified as discussed under Geology, Aquatics/Fisheries, Scenic Resources, Biodiversity, and Threatened and Endangered Species.

Wilderness Act

Section 4(b) of the Wilderness Act of 1964 states: "Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." The CMW would continue to serve the public purpose of recreation, scenic, scientific, education, conservation, and historic use. Therefore, Alternative II would be consistent with the Wilderness Act of 1964.

Section 4(d)(3) of the Act states that holders of unpatented mining claims validly established as of midnight December 31, 1983 shall be accorded rights under the 1872 Mining Act on those NFS lands designated by the Act, as a wilderness area. This same section states that lands within a wilderness going to patent shall convey only title to the mineral deposits within the claims. The right to cut and use needed timber from those claims is granted if needed timber is not otherwise reasonably available. The United States reserves all title to the surface and surface resources of the claims. Reasonable stipulations may be prescribed "... for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed." This section indicates that minerals operations as proposed can occur within the wilderness but may be subject to management requirements that are above and beyond those normally imposed on operations outside of a wilderness, so long as such management requirements do not prevent the operator from exercising due rights under the United States mining laws.

The ventilation adit portal and the underground mining proposed in the wilderness are considered necessary for the mining operations. Noise from the ventilation adit could degrade the wilderness character. However, this is not inconsistent with the Wilderness Act since this facility may be required for mine-worker health and safety.

Alternative III

Apparent Naturalness

The wilderness ventilation adit could be potentially visible from more areas in the wilderness than the Alternative II location because of its location on a nearly vertical face. However, surface disturbance at the adit portal would be reduced to an estimated 800 square feet. Final design standards that reduced the visibility of the ventilation adit and helped blend other mine facilities outside the wilderness with the surrounding landscape would reduce impacts to the CMW and its visitors. Reducing the noise levels emanating from the air intake adit, at the mill site, and at other mine operations would reduce the amount of noise that could potentially reach the wilderness (see Sound). These measures would help maintain the apparent naturalness of the wilderness, and would provide more solitude and/or primitive recreation experience for a majority of wilderness visitors.

Monitoring lake levels at Cliff and Copper lakes and performing more detailed rock mechanics monitoring and frequent review of mining plans would reduce or minimize the potential for subsidence in the wilderness.

Solitude/Primitive Recreation

Road closures of 0.8 miles on Chicago Peak Road and 2.1 miles on Orr Gulch Road would reduce motorized access to the wilderness in those areas, slightly increasing the opportunity for solitude.

Alternative IV

Apparent Naturalness

The mill at the junction of the East and West forks of Rock Creek (1.25 miles from the wilderness) would be visible from some locations within the wilderness such as Ojibway and Rock peaks (see Scenic Resources). Sounds and odors impacts from the mill would occur in different areas of the wilderness than those associated with the West Fork mill site but would generally be unnoticeable. Exceptions to this would be intermittent blasting and the wilderness ventilation adit fan.

Cumulative Effects

Cumulatively, mining, timber harvest, and other existing or planned activities outside of the wilderness would alter some natural processes occurring in the wilderness in the short term; these processes would have negligible effects in the long term. Additional mineral activity that may occur within the wilderness is expected to consist primarily of surface sampling, surveying, and core drilling, although none is currently proposed. These activities have occurred in the past with some evidence that habitat use by goats has been altered. This could have a slight effect on natural integrity.

Many human activities that occur outside the wilderness are already seen and/or heard from the wilderness. The Rock Creek Project in combination with other future activities would slightly reduce the apparent naturalness of the CMW. Cumulative activities would not change the overall condition of this narrow wilderness.

The Rock Creek Project in combination with the Montanore Mine near the wilderness would increase the chances for wilderness visitors to see, hear, or smell human activities beyond what is currently evident. The apparent naturalness of the area would decrease slightly with increased human use. Evidence of these projects would not be apparent from the wilderness lakes most often visited by wilderness users. Rather, opportunities to experience solitude or a primitive recreation experience would decrease with human use of the area.

CULTURAL RESOURCES

Summary

Eight historic sites were documented during the cultural resource investigations. All of these properties were determined to be ineligible for listing on the NRHP by consensus of the KNF and Montana State Historic Preservation Office (SHPO). No mitigation measures would be necessary prior to impacting these sites.

General Introduction

If any buried artifacts or human remains were discovered during construction, the National Historic Preservation Act requires that the SHPO be notified immediately. A plan would be developed to address each discovery on a case-by-case basis.

Alternative I

No direct, indirect, or cumulative changes or impacts to cultural resources would occur except those that could occur from other development of the project area. The timing and nature of these impacts is unknown. Site 24SA173 was burned in spring 1994 and there are no remaining structures to be impacted by future activities.

Alternatives II and III

No known cultural resources would be directly affected by the construction of the mill, portals, roads, borrow areas, slurry lines or dump facilities. Site 24SA173, a historic homestead site on private land, would be buried by construction of the tailings impoundment and associated features. The site has been determined ineligible for listing on the NRHP and no mitigation measures would be necessary (Caywood 1986). Site 24SA370, a historic logging site (springboard stumps), would be potentially disturbed by the construction of a wetlands mitigation site. This site also has been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

The five historic sites within the permit boundary outside areas of direct disturbance would receive indirect impacts from changes in the historic landscape from increased traffic, equipment storage, road construction, staging operations, and other construction-related activities. All cultural resources indirectly affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

Increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to sites in the area over the mine life potentially would impact all existing historic sites. Sites with standing structures (24SA169 and 24SA172) have a higher profile and would be more vulnerable to cumulative impact. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

Alternative IV

A short segment (about 400 feet) of Site 24SA328, the Heidleberg Mine Road, would be phisically impacted by mine/mill site construction. This site was determined ineligible for listing on the National Register of Historic Places. No mitigation measures would be necessary.

Cumulative Effects

Human disturbance to cultural resources would increase from the project as well as from reasonably foreseeable activities within the drainage. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

NATIVE AMERICAN TREATY RIGHTS

Under the No-action Alternative, no change in the status of current Treaty Rights would occur.

Under the action alternatives, there may be effects on fisheries, wildlife, and vegetation as well as limits on Tribal access during the life of the project that would affect the ability of Tribal members to fully use their current treaty rights. These effects may vary in magnitude by alternative but are common to each. Impacts cannot be quantified based on tribal information submitted to date.

Alternative I

There would be no change in the status of current treaty rights within the Rock Creek drainage except on those that could be affected by proposed timber sales on NFS lands.

Alternative II

The proposed action affects about 3.6 square miles of land (private and public) within the original 28,000± square miles encompassed by the Hellgate Treaty. The amount of privately-owned or "claimed" lands currently within the boundary is unknown. However, the tribes have experienced a gradual erosion of treaty rights resources over time. The actual use of this drainage by tribal members cannot be quantified nor will the tribes identify specific sites of religious, medicinal, or cultural importance.

Impacts to fisheries, grizzly bear, vegetation, and access could affect tribal rights to a minor degree within this drainage. Bull and westslope cutthroat trout may decline if project impacts create habitat degradation (see Aquatics/Fisheries). Brook trout may be impacted as well. Grizzly bear habitat could be fragmented between its north and south ranges, resulting in a loss of its presence in the Rock Creek drainage (see Threatened and Endangered Species). Tribal members could suffer from the knowledge that the grizzly bear, one of its cultural/spiritual symbols was impacted. Impacts to wildlife habitat/vegetation, old growth, and wetlands could potentially affect plant species of interest to the tribes. Impacts that project-related activities would have on plant-related treaty rights is unknown because, other than huckleberries, no specific plant species have been identified as important. Huckleberries at the mill site would become unavailable in the short term.

Tribal access to the drainage would be generally increased due to the upgrade of FDR nos. 150 and 2741 but would be restricted from mine facilities sites. Road closures for grizzly bear mitigation would be in place until after operations ceased and reclamation was completed and then would be re-evaluated for their respective need to be reopened or to remain closed (see Transportation and Recreation).

Alternative III

This alternative would directly affect 3.9 square miles of land (public and private) within the original treaty lands.

The reduction in the amount of old growth habitat disturbed may reduce impacts to important vegetation but without knowing the species involved, the impact cannot be quantified. Additional mitigations for impacts to grizzly bear would also reduce impacts to this Tribal resource.

Alternative IV

This alternative would directly affect 2.4 square miles of the original treaty lands.

Impacts to vegetation-related treaty rights would be less than other action alternatives but cannot be quantified. Huckleberries at the upper mill site would not be affected by project activities. Less bear habitat would be affected and mitigations would be required to minimize the impacts. Tribal access above the confluence of the East and West forks of Rock Creek would remain at current levels although access would be improved between the confluence and Montana Highway 200. Access through mine facility areas would be restricted, but less road closure would occur.

Cumulative Effects

Increased access to the general project area could increase the use of treaty-related resources by the general public as well as Tribal members. Logging operations would impact additional areas of potentially significant plant species and increase the impacts to grizzly bears.

SOUND

Summary

Project development would cause noise impacts from both stationary sources (exploration adit generators, conveyors, mill operations, pumping stations and the rail load-out facility), and mobile sources (construction equipment, blasting, ore truck and employee traffic). The loudest stationary sounds would be audible within 2 miles under ideal transmission conditions. Under normal conditions, with the effects of topographic and vegetative absorption, noises from project facilities could be heard for about 0.87 mile. Vehicles traveling FDR No.150 and Montana Highway 200 typically would be heard 0.25 mile and 0.67 mile away, respectively. Mitigation measures and location alternatives could significantly reduce construction and operation noise impacts to the CMW, and eliminate noise impacts to residents near the proposed Hereford rail load-out under alternatives III and IV.

Alternative I

The upper Rock Creek area would continue to have quiet sound levels characteristic of rural areas and wilderness lands (Parker 1987), while the lower Rock Creek area would have sound levels primarily influenced by human activities along the Clark Fork River Valley. Existing natural sound levels in the upper Rock Creek drainage ranging from 25 to 32 decibels-A scale (dBA) (Parker 1987) would continue, with occasional elevated noise levels caused by logging and firewood gatherers. Infrequent vehicle use of FDR No. 150 would continue to generate about 50 dBA, while growing traffic levels on Montana Highway 200 would gradually increase local noise levels from an estimated 70 dBA toward 74 dBA as measured at the edge of the roadway. These noises generally would be buffered by terrain or vegetation. Sound levels at the Hereford rail siding would continue as moderately quiet, except for passing trains.

Alternative II

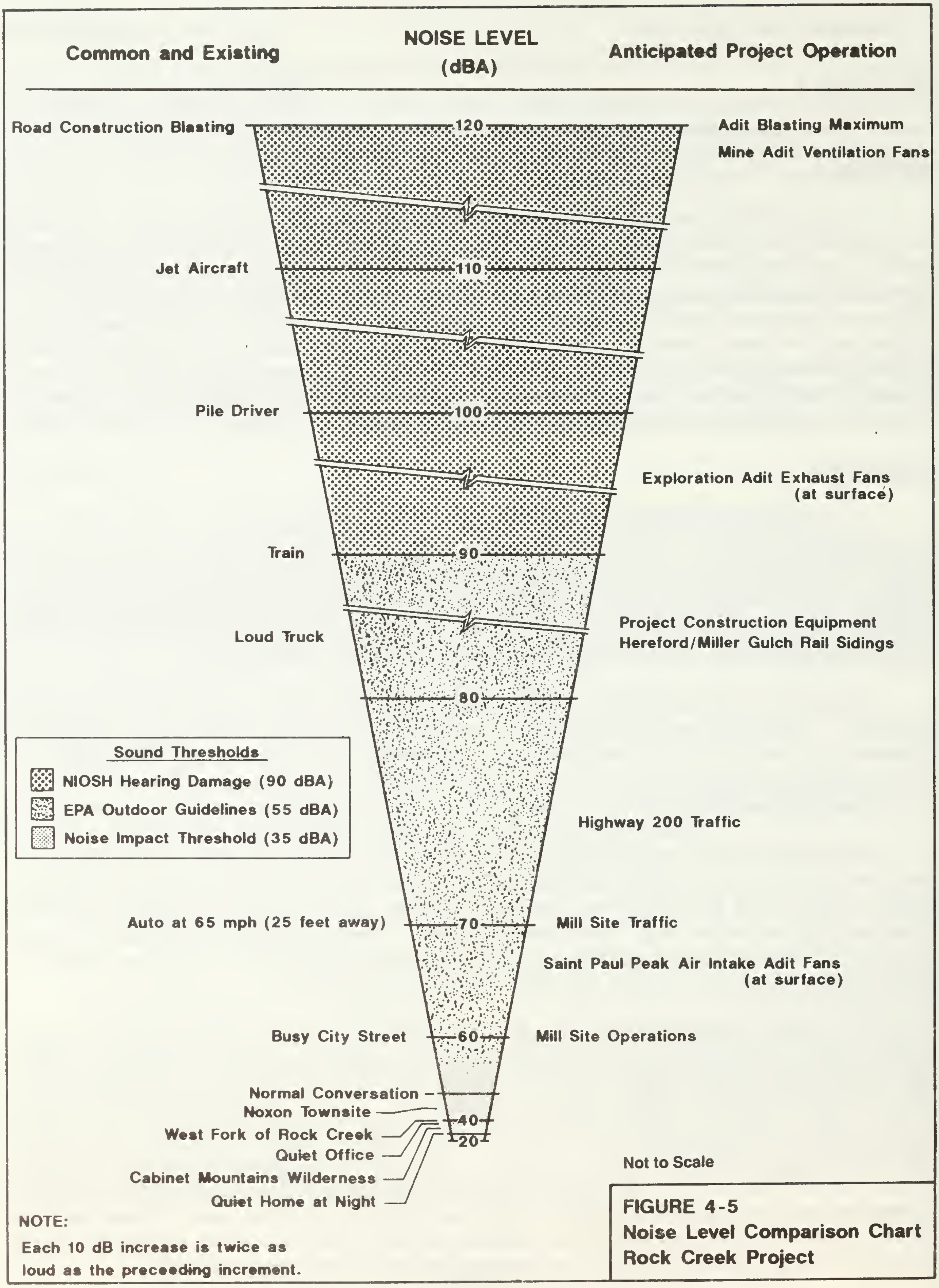
Project impacts are difficult to predict because actual project noise impacts would be a function of 1) existing sound levels, 2) hearer-desired sound levels, and, 3) the characteristics and conduction of noise. The desired Rock Creek drainage sound levels are "quiet" and are generally of a natural origin (Rodman 1987) because most of the area is managed for wilderness, grizzly bear habitat, dispersed recreation and intermittent timber cutting. Expected sound levels would generally not exceed 55 dBA (U.S. Environmental Protection Agency 1974; Harrison, Clark, and Stankey 1980).

The project would noticeably increase both the level and character of noises at the mill and mine portal sites. The project haul roads and load-out would also cause elevated noise levels. **Figure 4-5** compares typical noise levels with expected levels to be generated by selected project components.

Construction-Phase Effects

The loudest noises would be generated intermittently at the mill site and adits when peak noise levels would reach up to 125 dBA measured at 900 feet for a few seconds during adit and mill site blasting. Noise would be loudest when blasting was carried out at the surface; underground blasting noises reaching the surface would be somewhat muffled. When underground, the primary source of construction noise would be the ventilation fans, which generate 120 decibels. Bulldozers, trucks and other construction vehicles would be expected to generate up to 85 dBA.

To provide ventilation during adit construction for both the ventilation and mine adits, 4-foot-diameter fans encased in tubing would be located between the entrances and the working faces of the adits. As mining progressed, these fans would be moved back into the mine 500 feet and additional fans added at 3000-foot intervals. These ventilation fans operate continuously, generating up to 123 dBA and would be clearly noticeable (45 dBA) up to 1.0 mile away. The fans could be audible for more than 2.0 miles, depending on noise transmission conditions. When adit construction was complete, these fans could be located within the mine, decreasing surface noise levels by an estimated 3.0 dBA per 1,000 feet of tunnel or a possible reduction of 29 dBA. Following relocation inside the mine, an unmuffled mine ventilation fan would still generate up to an estimated 114 dBA at the mine portal, audible for slightly more than 1.0 mile on the surface (at a level greater than the 35 dBA background level).



Not to Scale

NOTE:

Each 10 dB increase is twice as loud as the preceeding increment.

FIGURE 4-5
Noise Level Comparison Chart
Rock Creek Project

Chain saws, logging trucks, and other construction equipment used for powerline and tailings pipeline construction would also generate an estimated 110 dBA at 50 feet. Although these activities would take place in hilly, forested terrain, all of these sounds would be audible for 1.0 mile or more. Surface blasting, trucks with inadequate mufflers, and truck back-up alarms could be audible for up to 2.0 miles.

During project construction, most activities would be expected to regularly exceed the EPA 55 DBA health and welfare noise guideline (U.S. Environmental Protection Agency 1974). Personal hearing protection measures would be necessary to protect workers from during exposure to noise levels greater than 90 decibels for more than 8 hours per day (National Institute for Occupational Safety and Health 1978). Under optimum sound transmission conditions, the adit and mill construction sounds reaching residential areas in the Clark Fork Valley would not be intrusive (estimated 35 to 50 dBA). Noise from constructing the impoundment's starter dams (adjacent to Montana Highway 200) would be audible for 1.0 mile or more in all directions, including some residential areas near Noxon Reservoir.

Infrequent adit and mill site blasts of 125 dBA could generate 60 to 80 dBA bursts reaching residential areas in the valley and the CMW. Occasional bursts of construction and blasting noise would cause local displacement of some big game species (Environmental Protection Agency 1985) (see Biodiversity).

Construction truck traffic to and from the exploration adit, mill site, tailings impoundment, and rail load-out would temporarily increase noise levels. Haul trucks with properly operating mufflers would be expected to generate up to an estimated 86 dBA at 50 feet. The noise effects would be similar to those of trucks transporting logs from a timber sale.

Powerline construction would temporarily increase daytime sound levels along the proposed utility corridor. During the estimated 3-month line construction period, equipment would generate up to 115 dBA at 50 feet.

Operation-Phase Effects

General mine operation noise levels of 52 to 62 dBA would be noticeably louder than the natural upper Rock Creek sound levels (30 dBA), but generally would be lower than mine construction levels (about 86 dBA). Most mine and mill operating sound levels would slightly exceed the EPA 55 dBA outdoor noise guideline. Primary noise sources would be the conveyor, crushing plant, and ball mill, each of which would be expected to produce between 52 and 62 dBA. Once the mine adits intercepted the exploration adit, the loudest project noise would be generated from the mine ventilation fan near the mouth of the exploration adit at an estimated 114 dBA for over 1.0 mile. Underground blasting would be expected to produce peak surface sounds of up to 55 dBA, but generally would be marginally audible at the surface (Parker 1987). Mine and mill site operations sounds reaching the Clark Fork Valley generally would be inaudible.

Operations around the tailings impoundment normally would have lower noise levels, but during the first 7 years of mine operations, the ongoing embankment construction would occasionally emit up to 110 dBA. Ore haul trucks and employee traffic would generate increased traffic noise levels along FDR No. 150 and Montana Highway 200. This increased traffic would significantly increase noise levels (from 30 to 70 dBA) on FDR No. 150, but would have smaller noise increases on Montana Highway 200 (increasing levels from 70 to 74 dBA).

The proposed 230 kV powerline from near Montana Highway 200 to the upper Rock Creek mill site would produce a soft hissing and crackling sound during wet weather (up to 43 dBA). In fair weather, these sounds are virtually inaudible.

Activities at the Hereford rail load-out would generate up to 87 dBA from haul truck/rail car loading six to eight times a day, between 8 a.m. and midnight, 7 days a week. This would substantially increase noise levels in the Hereford residential area (12 hours) compared to periods without train noise.

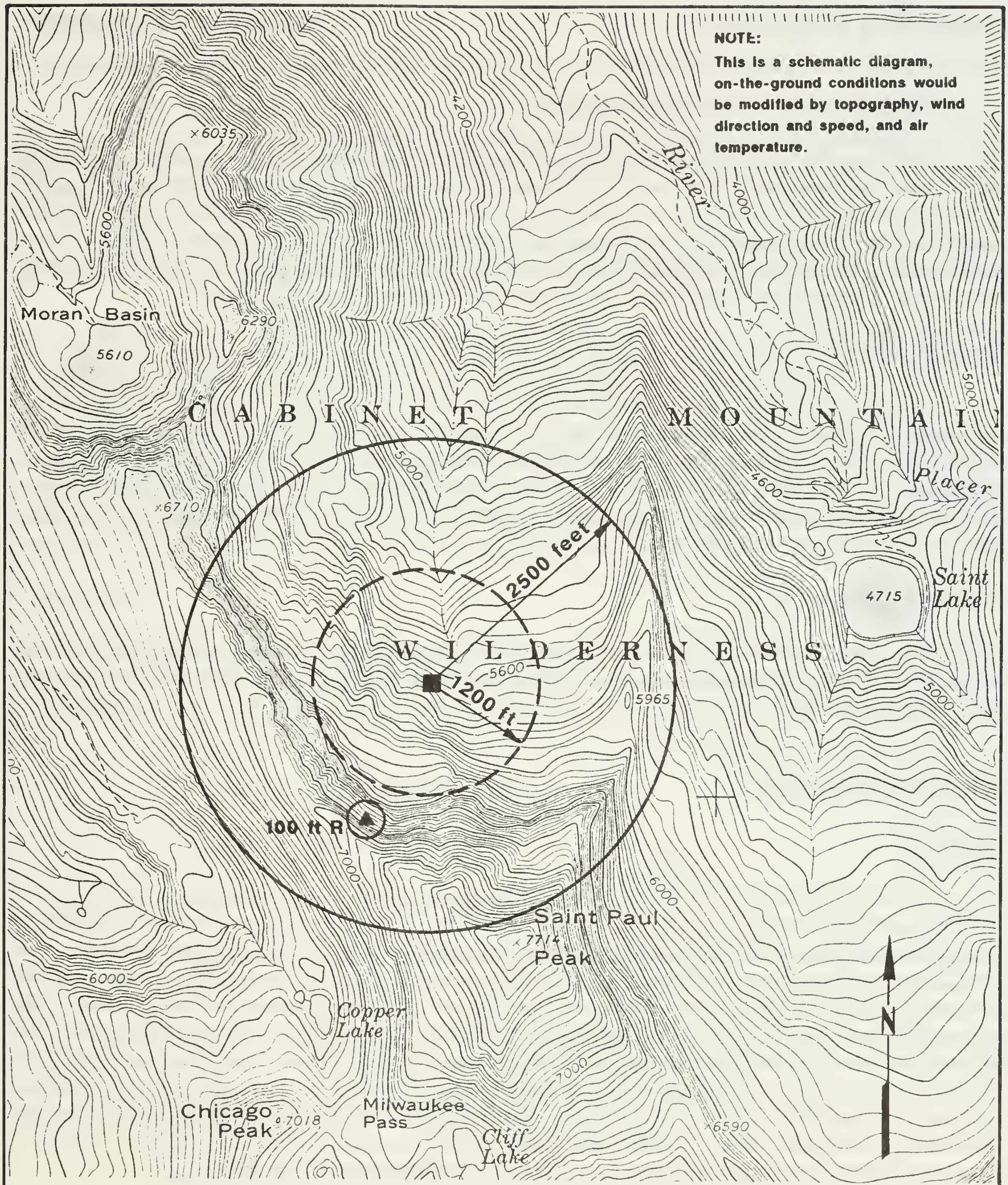
Cabinet Mountains Wilderness (CMW)

Noise generated from exploration adit construction, mine adit construction, mill site construction and operations, and the mine air ventilation fan would be audible inside the CMW. The wilderness boundary is about 0.25 mile above the exploration adit and 1.0 mile above the mill site. The ridges to the north and east of the upper mill site are within the wilderness boundary. Equipment creating sound levels of 115 dBA or louder would be audible at wilderness locations within 1.0 mile of the adit or mill. Mine operations sounds (particularly the 114 dBA from the ventilation fan) would be noticeable at the wilderness perimeter. Other than the ventilation fan noise, most operation noises normally would not be noticeable in comparison with existing wilderness sound levels (25 to 35 dBA). Under optimal sound transmission conditions, the mill operating noises reaching the wilderness from the upper Rock Creek mill site could, on occasion, exceed background wilderness sound levels. Topographic relief would help screen interior wilderness areas from mill site noises, but any mining noises would be disturbing to wilderness visitors because of their obvious mechanical origin (Environmental Protection Agency 1985).

The proposed ventilation intake adit on the north side of Saint Paul Peak (inside the wilderness) would emit an estimated maximum of 67 dBA (based on Harrison 1978). This noise would be substantially above natural ambient wilderness sound levels of 30 dBA. Following construction of the ventilation adit in about the fifteenth year of mine operations, an estimated 450 acres of wilderness would be exposed to elevated noise levels (see **Figure 4-6**), for at least 19 years. The ventilation fan noise would be expected to be the dominant sound in a 100-acre wilderness cliff area. Because wilderness visitors expect quiet and solitude, the fan's mechanical sounds would be intrusive to wilderness visitors.

Alternative III

Mitigation measures would reduce the project's major noise sources (construction equipment, ventilation adit, and mining/mill operations) thereby minimizing noise impacts to sensitive noise locations, primarily the CMW and local residences. Locating the rail load-out near the Rock Creek tailings impoundment would eliminate noise impacts at the Hereford load-out and substantially reduce impacts to nearby residents along Montana Highway 200.



NOTE:
This is a schematic diagram, on-the-ground conditions would be modified by topography, wind direction and speed, and air temperature.

■ Proposed Ventilation Adit Portal
▲ Alternate Ventilation Adit Portal
○ Area where mine noises would be heard
◌ Area where mine noises are dominant

FIGURE 4-6
Noise Influence Area in the Wilderness
Rock Creek Project

Cabinet Mountains Wilderness (CMW)

Placement of the wilderness ventilation adit near Saint Paul ridge would expand the zone of mine noise impact, compared to Alternative II, if all other factors remained constant. However, Alternative III ventilation adit fan noise mitigations would be reduced by 21 dBA, to 46 dBA. The wilderness ventilation adit would be expected to elevate noise levels within 400 feet of the adit or on about 12 acres of the CMW. The net effect of placing the ventilation adit higher on the ridge and reducing the noise level would be to reduce the area in the wilderness where fan noise would dominate.

Alternative IV

Noise impacts would be mitigated the same as under Alternative III. The lower mill site would provide a 25 percent greater noise buffer distance to the CMW (1.25 mile versus 1.0 mile in alternatives II and III). Noises reaching the CMW would be generally expected not to exceed normal ambient wilderness noise levels (35 dBA). Retention of forest screening around the mill site and other measures would provide some additional noise attenuation to meet the 55 dBA standard measured 250 feet uphill from the crushing plant and ball mill.

Cumulative Effects

The cumulative effect of the Rock Creek and Montanore projects would be to increase the acreage within the CMW where human sounds were noticeable. However, the two projects would not have any areas of noise overlap.

SCENIC RESOURCES

Summary

All action alternatives would result in major and significant visual impacts for the Rock Creek drainage and Clark Fork Valley. The proposed impoundment would affect many views in the Clark Fork Valley, including those from Noxon, along Highway 200, and the lower portion of Noxon Reservoir. The form, color, and texture of the impoundment and its large size would contrast dramatically with the surrounding landscape. Effects would last for several decades until sufficient tree and shrub growth could be established on impoundment faces to reduce the contrast with surrounding terrain and vegetation. The proposed and alternate mill sites in the Rock Creek drainage would introduce an industrial facility to a forested landscape and dramatically alter existing views for recreationists and other users of FDR nos. 150 and 2741 and NFS lands near the project. The West Fork mill site would not be visible from any surrounding wilderness peaks. Under Alternative IV, the confluence mill site would be visible to wilderness visitors in background views from Ojibway and Rock peaks in the CMW.

The utility and transportation corridor(s) with cleared rights-of-way and paralleling power- and pipelines would significantly change the existing setting along FDR No. 150 in the Rock Creek drainage.

The proposed Hereford rail load-out under Alternative II would create a significant visual intrusion for surrounding residents. Under alternatives III and IV, traffic and dust associated with the Miller Gulch rail load-out would create a minor visual intrusion for travelers on adjacent FDR No. 150 (segment to Government Mountain).

Under all action alternatives, construction of the 3-acre waste rock dump and portal area for the exploration adit would result in minor visual impacts to recreationists in the upper Rock Creek drainage.

Alternatives III and IV would result in less visual impact compared to Alternative II due to both ASARCO- and Agency-proposed mitigations although impacts for the impoundment and mill site would still be major and significant. Alternative IV would result in the least scenic impacts.

None of the prescribed on Forest Plan visual quality objectives (VQOs) or time frames could be able to be achieved under action alternatives during mine life. The impoundment surface under Alternative II may meet Retention VQO standards. Additional reclamation requirements and mitigations under alternatives III and IV would increase the likelihood that mine facilities would meet prescribed VQO standards sooner than Alternative II but not for several decades.

Introduction

Drawings from both Visual Management System (VMS) and Forest Plan VQOs, the Agencies designated VQOs for project facilities (see **Table 4-40**) to assess visual impact, guide development of visual mitigation measures, and serve as the standard for evaluating long-term reclamation success. These are:

- ***Preservation*** (Forest Plan definition);
- ***Retention*** (VMS definition);
- ***Partial Retention*** (VMS definition); and
- ***Rehabilitation*** - a short-term, life-of-mine management alternative used to return existing visual impacts in the natural landscape to a desired visual quality (VMS definition).

VMS objectives were selected for most project facilities rather than Forest Plan objectives due to concern for scenic quality in the project area, high viewer sensitivity in the Clark Fork Valley , and the more rigorous standards of VMS objectives compared to the Forest Plan's. Other VQOs included in **Table 4-40** but not applied to project facilities are:

- ***Modification*** (Forest Plan definition);
- ***Partial Retention*** (Forest Plan definition); and
- ***Preservation*** (VMS definition).

TABLE 4-40.
Long-term Project Visual Quality Objectives (VQOs)

Project Facilities	Visual Quality Objectives	
	VMS	Forest Plan
Rock Creek tailings impoundment	**Retention**[1]	Partial Retention
West Fork mill site (including waste rock dumps and utility corridor)	**Partial Retention**	Modification
Confluence mill site (and utility corridor)	**Partial Retention**	Modification
Exploration adit	**Partial Retention**	Modification
Ventilation adit	Preservation	**Preservation**[2]

[1] VQO in bold type would be applied to this project component.

[2] A Preservation VQO under VMS would prohibit all management activities except for very low impact recreation facilities. A Preservation VQO from the Forest Plan would result in management activities that are not detectable to the visitor.

Alternative I

Under Alternative I, more gradual and less dramatic changes to the landscape would occur in the Rock Creek drainage and Clark Fork Valley near Noxon. The landscape would continue to undergo modifications associated with timber harvesting, commercial and residential development, and other activities. The Montanore Project would affect the existing landscape character on the east side of the CMW, but would have no direct visual effects near Rock Creek. Recreation-related improvements that could be proposed for Federal Energy Regulatory Commission relicensing of Noxon and Cabinet Gorge dams could result in a more developed recreation setting around these reservoirs.

Alternative II

Alternative II would result in long-term landscape changes from mining operations and the addition of industrial mining facilities to the forest landscape during mine life. Project-related population increases, housing development, increased traffic levels, and secondary economic growth in the Clark Fork Valley would contribute to a more developed setting. This development could extend from Noxon and Heron to Thompson Falls during the construction and operation phases of the project.

Viewpoints located in the Clark Fork Valley and Rock Creek drainage used in visual simulations of project facilities as shown on **figures 4-7** and **4-8**.

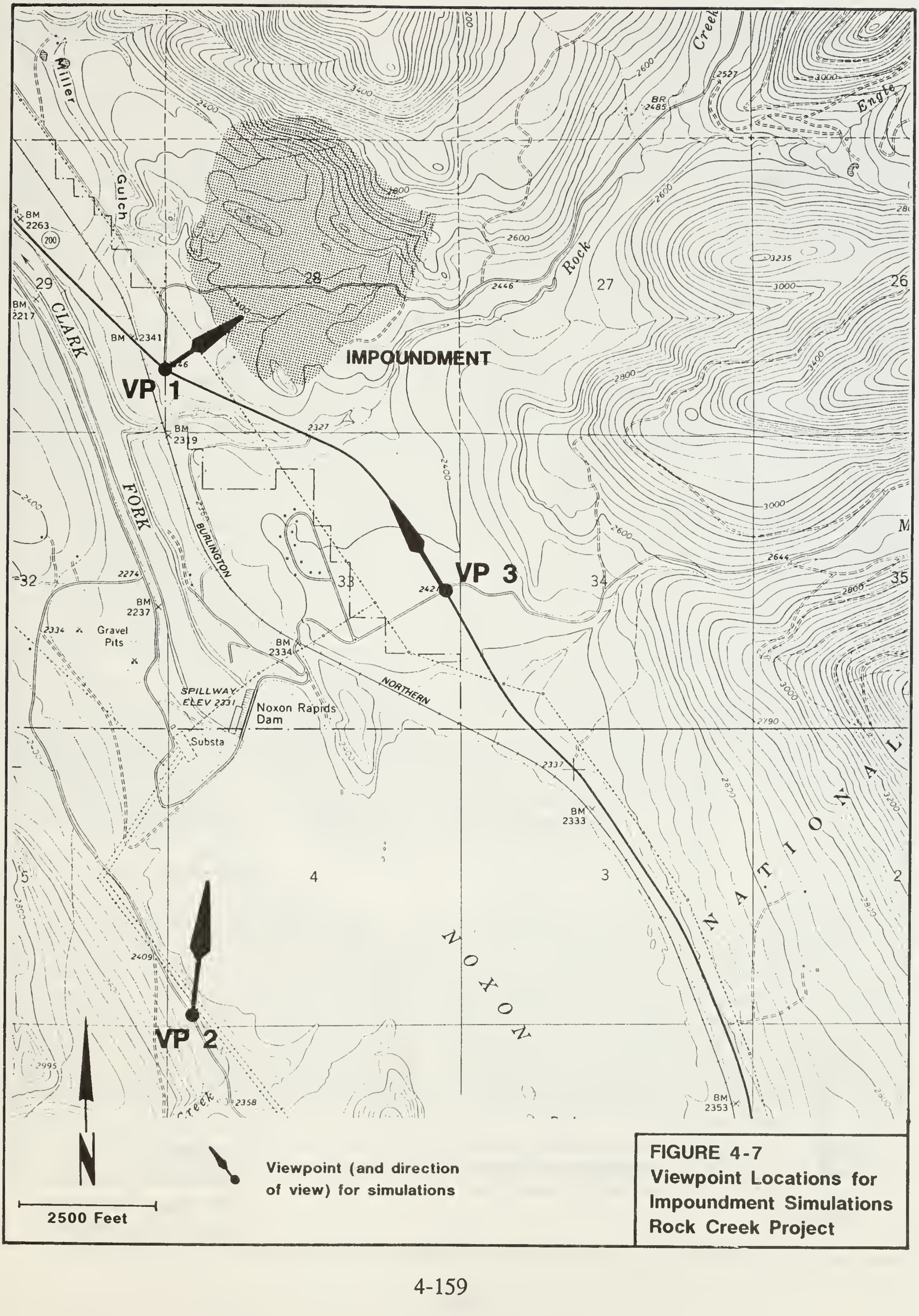


FIGURE 4-7
Viewpoint Locations for Impoundment Simulations
Rock Creek Project

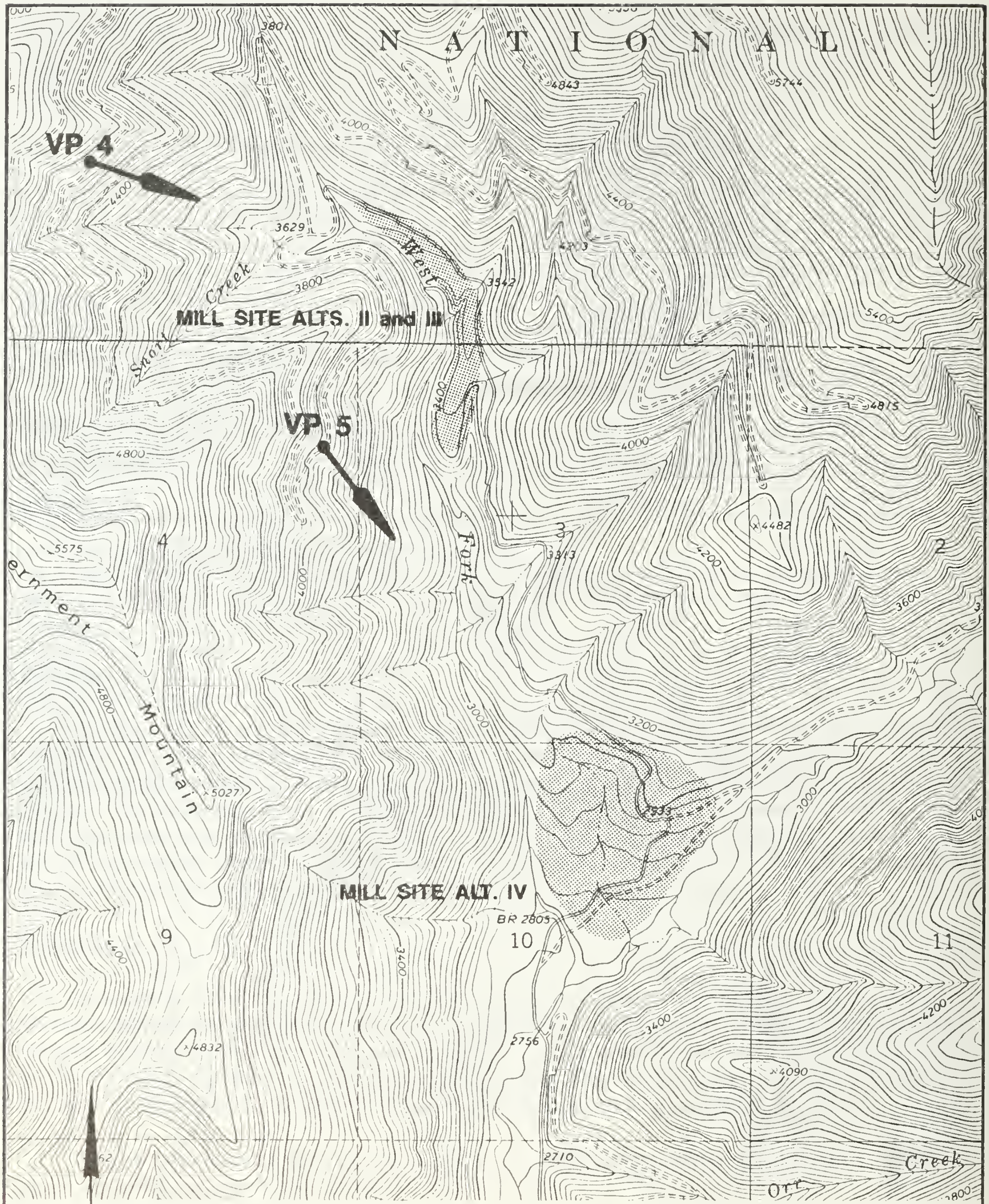


FIGURE 4-8
Viewpoint Locations for Mill Sites Simulations
Rock Creek Project

Exploration Adit

The exploration adit's 3-acre waste rock dump and adit portal would create a noticeable landscape alteration. Potential views would extend to portions of the Rock Creek drainage along FDR No. 150 on Government Mountain and the Clark Fork Valley. The background distance of this adit from most viewpoints in the Clark Fork Valley (greater than 3 miles), and the relatively small area disturbed would decrease impacts to minor levels. Lights for night-time operation or sunlight reflecting off the steel fuel storage tank and/or building at the adit's portal would be the most noticeable elements of this facility.

Upgrading and reconstruction of 1.2 miles of FDR No. 2741 (Chicago Peak Road) would include widening from 10 to 14 feet, construction of additional turnouts, and a 1,200-foot spur road, creating landscape scars from cuts and grading. These changes would be noticeable from viewpoints in the upper Rock Creek drainage and the portion of FDR No. 150 within the Snort Creek drainage. Effects would diminish once revegetation was successfully established. Snowplowing on this road would increase its visibility for those winter recreationists who used the upper Rock Creek drainage.

Other support facilities for the exploration adit also would contribute to visual impact. Some clearing of undergrowth would be necessary for portions of the 6-inch temporary pipeline between the adit and Clark Fork River resulting in short-term and minor impacts. The most visible portion of this clearing would extend down ridgelines from the exploration adit to the valley floor of the West Fork of Rock Creek -- a distance of about 1.5 miles (with an elevation drop of approximately 2,300 feet). Clearing and pipeline location for the remainder of this corridor on the valley floor of Rock Creek and the West Fork of Rock Creek adjacent to FDR No. 150 would result in slight visual impacts.

Support facilities for the exploration adit -- office, changehouse, warehouse, and employee parking -- located adjacent to FDR No. 150 in lower Rock Creek, would create the first noticeable project-related change in this part of the drainage. Visual effects of these support facilities would be minor, but the daily movement of personnel on rotating shifts and delivery of supplies to the exploration adit would extend an industrial character throughout the drainage along Forest Service roads. Buildings would be removed after facilities for the main adit were operational.

Tailings Impoundment

The proposed tailings impoundment would contribute most to long-term landscape changes, by introducing a large, new, and incongruous landform to the surrounding landscape (see **Figure 4-9**). The contrast and visibility of the impoundment would increase over the life of the project as it became larger and height increased above the 80- to 90-foot height of surrounding trees, becoming more of a visual intrusion for those who value the existing landscape in the Clark Fork Valley near Noxon. Contrast would remain high until sufficient tree growth was established on the impoundment face following mine closure. It is unlikely that tree or shrub growth of sufficient height or density could be established on the fine tailings and slimes of the impoundment surface to blend effectively with the surrounding landscape, impacting recreationists using surrounding trails, roads, and wilderness viewpoints located above the impoundment. Establishment of grass cover during mine operation would reduce the grayish-white color of the impoundment faces, but would still result in a light green or tan color that contrasted with adjacent tree-covered hillsides. Visual impacts of the tailings impoundment under Alternative II for residents of the Clark Fork Valley surrounding Noxon, Highway 200 travelers, and recreationists using Noxon and Cabinet Gorge reservoirs would be significant.

Noxon area residents would have middleground views (about 2 miles distant) of the impoundment with locations along the Clark Fork River at Noxon providing the most unrestricted views. Montana Highway 200 travelers would have foreground to middleground views (0.25 to 3 miles distant) of the tailings impoundment where the existing highway alignment provided direct unscreened views of the proposed site. Potential views for highway travelers could extend for several more miles if highway alignments changed or screening was removed.

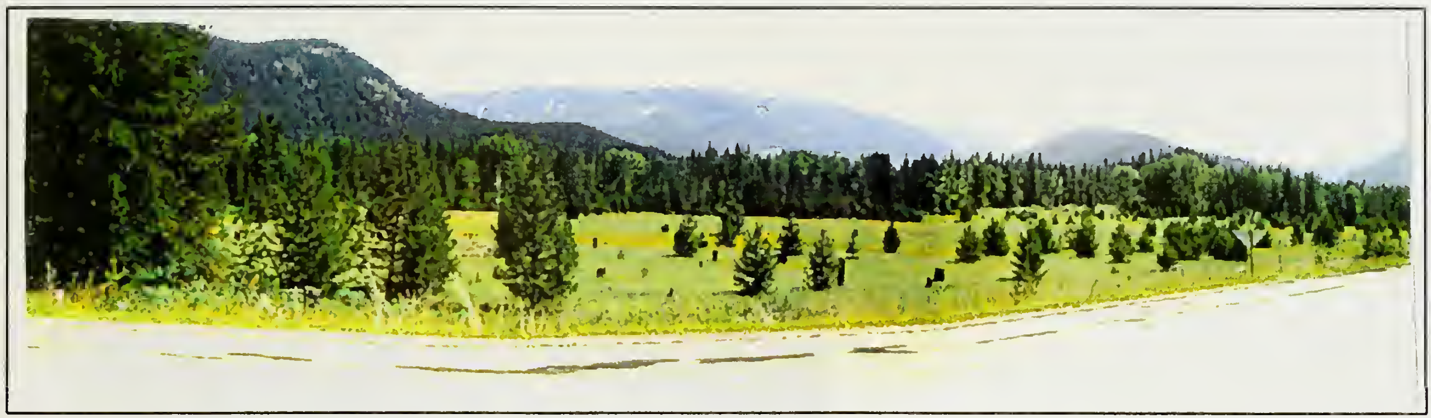
Recreationists on and around the lower portion of Noxon Reservoir and upper portion of Cabinet Gorge Reservoir, where screening vegetation was not present, would have unrestricted views of the proposed tailings impoundment (see **Figure 4-10**). Locations along the west edge of Noxon Reservoir would provide the most unrestricted views of the impoundment. Recreationists and other users of the west loop of FDR No. 150 to Government Mountain would have immediate foreground views (less than 0.25 mile) of the impoundment where this road joins Montana Highway 200. Recreationists using the proposed route of FDR No. 150 southeast of the impoundment would have foreground views of the impoundment.

Mine, Mill and Associated Facilities

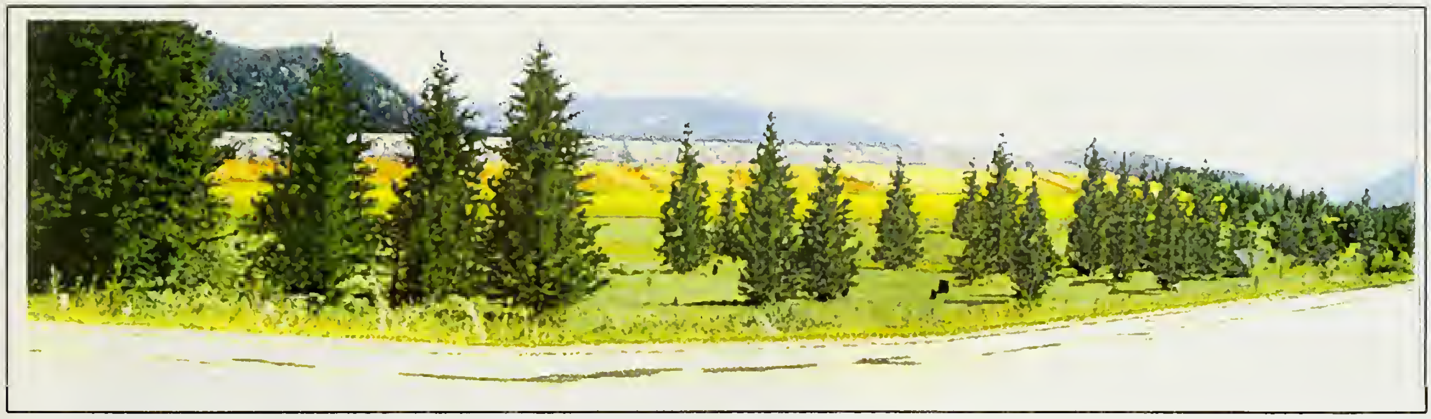
The mill site would create an industrial setting on NFS lands within the Rock Creek drainage during operation of the mine. The adit and access roads, conveyor system, substation, and buildings, as well as other support facilities, would contribute to a developed industrial setting dramatically different from the present forested landscape.

Project facilities would be highly visible (foreground views) to recreationists using relocated FDR No. 150 (where it would skirt the mill site) due to the absence of vegetative screening and high contrast between the industrial mine facilities and surrounding natural setting. The mill and associated facilities would be intermittently visible from FDR No. 2741 (middleground views) to recreationists accessing or leaving the CMW and to recreationists using Government Mountain in the Snort Creek drainage. The mill facilities would be a visual intrusion to those recreationists and forest users who value the existing, more natural setting. Mill facilities would cover approximately 29 acres, with reclaimed postmining topography creating a flat narrow bench along the valley floor approximately 0.1 mile wide and 0.7 mile long that would contrast with the gently sloping valley floor.

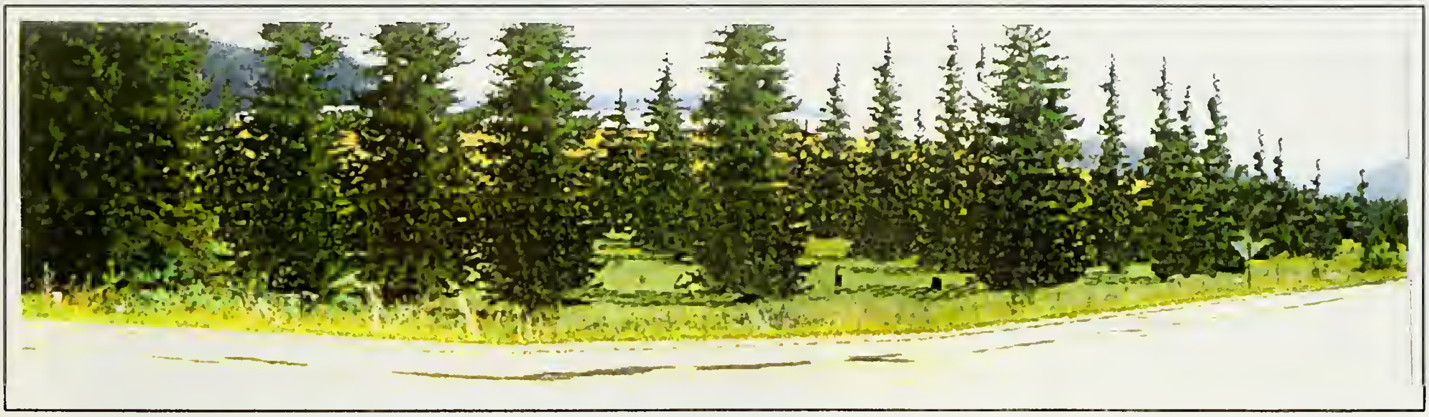
The 2,400-foot-long conveyor would create a strong linear feature in the viewed landscape as it dropped approximately 500 feet from the adits to the mill site. The 10-acre waste rock dump would create a permanent, noticeable, and unnatural shape on hillsides above the West Fork of Rock Creek. Reclamation and revegetation of the rock dump would be difficult, and its light color and fine texture would persist many years after mining ceased. New roads would create highly noticeable lines on hillsides above the mill site -- the 8,800-foot access road to the adits, the maintenance access road to the surface conveyor transfer point, and temporary access trails for construction of conveyor towers and the powerline to the adits.



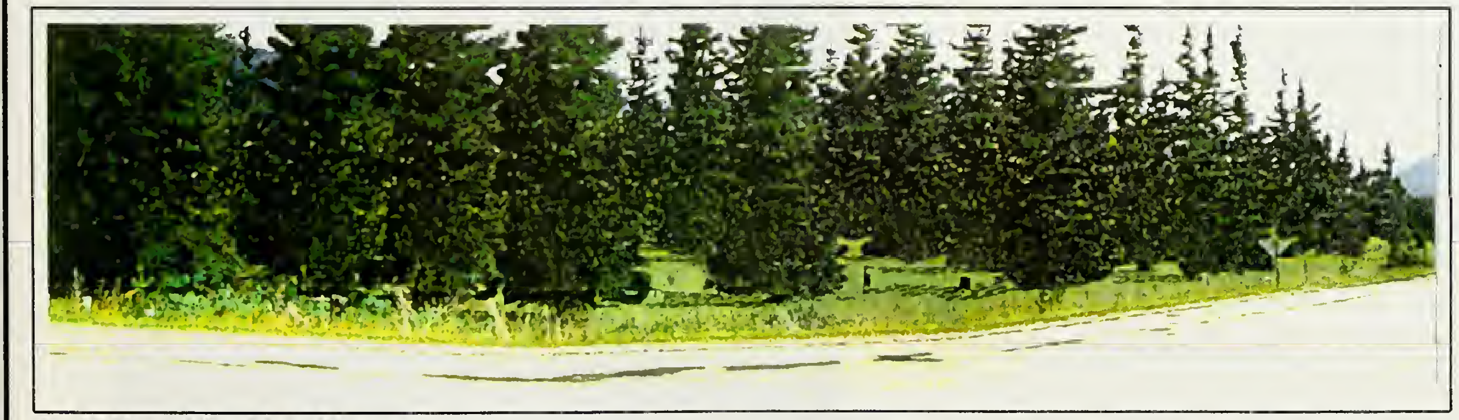
A. Existing View



B. Year 7 of Mine Operation

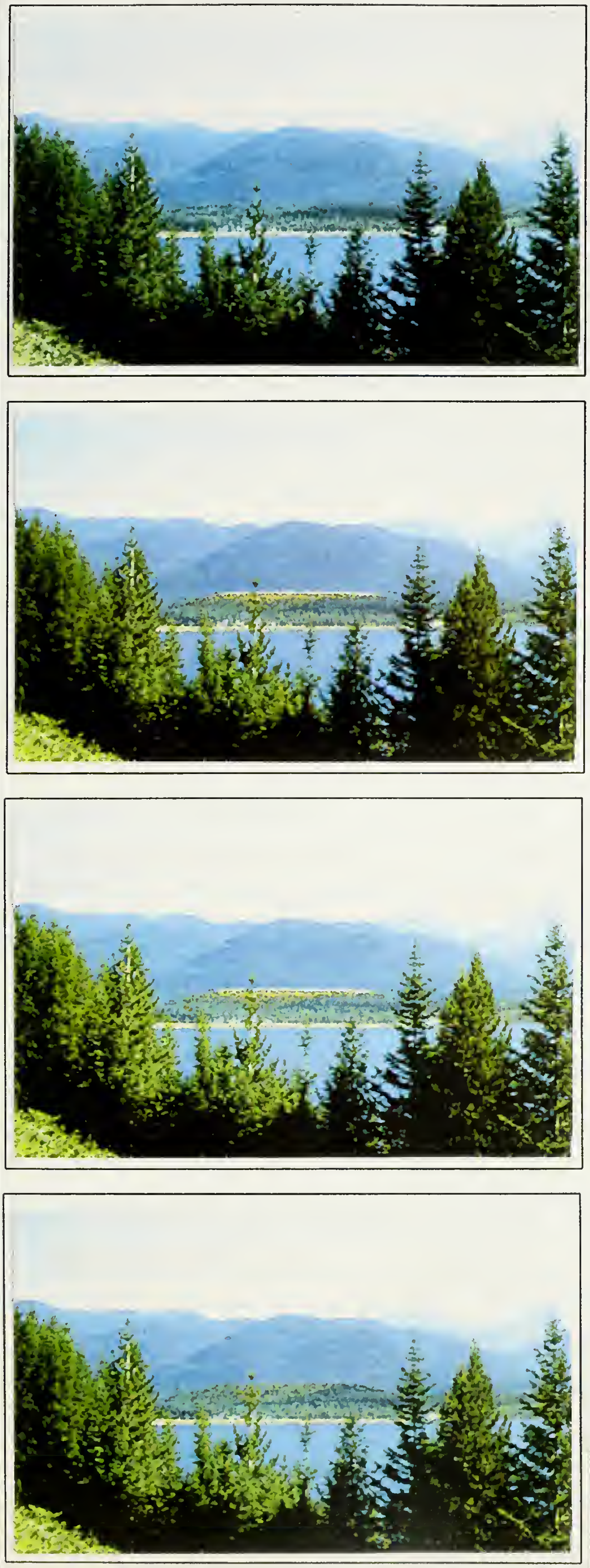


C. Year 33 of Mine Operation



D. 37 Years After Mine Closure

FIGURE 4-9
Visual Simulation of Proposed Tailings Impoundment (Alternative II) - From Intersection of FDR No. 150 and Montana Highway 200 - (Viewpoint 1)



A. Existing View

B. Year 7 of Mine Operation

C. Year 33 of Mine Operation

D. 37 Years After Mine Closure

FIGURE 4-10
Visual Simulation of Proposed Tailings Impoundment (Alternative II) - From FDR No. 2229 on South Side of Noxon Dam (Viewpoint 2)

Impacts to scenic resources from the mine, mill, and associated facilities under Alternative II would be significant.

Utility and Transportation Corridor

The utility and transportation corridor along Rock Creek would replace the existing tree-lined gravel road with a more developed linear corridor. Changes along FDR No. 150 below the confluence of the East and West forks of Rock Creek with its widened road and paralleling power- and pipelines would result in a cleared, linear, 100-foot wide corridor. An additional slurry and reclaim pipeline and road would be constructed parallel to and above FDR No. 150 on the west side of Rock Creek below Big Cedar Gulch but would not be visible to travelers along FDR No. 150. A 1-mile section of the utility corridor above the confluence would not parallel FDR No. 150 and would not be visible to travelers except near the confluence and mill site. Increased traffic levels would add to the developed character of this corridor and would continue for mine life.

Water Treatment Facility

The 10-acre site for the biotreatment system and ion exchange facility located northeast of the impoundment would have moderate visual effects during mine operation. Landscape alteration would result from creation of a level area for the facility on this steeply sloping site. Vegetation clearing also would be necessary, potentially increasing visibility of this facility for travelers and recreationists using the new FDR No. 150.

Hereford Rail Load-out

The proposed Hereford rail load-out would generate significant visual impacts (foreground views) for those residents immediately adjacent to the proposed site. The frequent (every 3 to 4 hour) arrival and unloading of concentrate trucks using the 12-foot high drive-over ramp, and night-time operation lighting would contribute to the visual intrusion for nearby residents.

Effects on CMW Visitors

Visitors to several mountain peaks within the wilderness would be able to see parts of the proposed project (middleground to background views) (see **Table 4-41**). Each of these wilderness peaks is visited by a few hiking parties each summer (see Recreation). Visitors to Goat, Rock, and Engle peaks, or those accessing the CMW by way of the Engle Peak (No. 932) or Wanless Lake (No.924) trails, would have a background view (3 miles and greater) of the impoundment. Neither the mill nor the exploration adit would be visible from the CMW though associated facilities such as improvements to Chicago Peak Road could be visible from access trails. The proposed ventilation adit could be visible to wilderness visitors using the north face of Saint Paul Peak. The degree of contrast and impact could vary slightly, depending on final location of the ventilation adit, but would likely be low. Existing roads, timber harvests, and development in the Clark Fork Valley also would be visible in views out of the CMW from these peaks. Proposed project facilities would not be visible from the numerous lake basins, such as Rock, Engle, Wanless, or Saint Paul lakes, within the CMW. Potential effects on wilderness visitors resulting from views of these project facilities could vary, depending on personal expectations.

TABLE 4-41.
Project Facilities That Would Be Visible From Wilderness Peaks by Alternative

Project facility	Cabinet Mountains Wilderness Peaks					
	Goat	Engle	Ojibway	Rock	Chicago	Saint Paul
Rock Creek impoundment (Alts. II through IV)	X	X		X		
Confluence mill site (Alt. IV)			X	X		
Ventilation adit (all)						X

X = visible

Compliance With Forest Service Visual Quality Objectives (VQO)

The industrial duration and character, and length of time required for landscape restoration of the proposed mining operations would make it impossible to meet the prescribed or Forest Plan VQOs under any of the action alternatives during mine operation (see **Table 4-40**). Instead, the short-term restoration objective of Rehabilitation would apply in the interim until the visual quality could be restored to the standards of the prescribed VQOs several decades after project completion.

The visual mitigation measures proposed by ASARCO in Alternative II would somewhat reduce the visual impact of mine operations in the long term. However, mitigations would not be able to overcome the dramatic differences in form, line, color, and texture between mine facilities and the surrounding natural landscapes to effectively achieve VQOs within the required time frames.

It may be possible for the visual quality of the face of the tailings impoundment, the mill site, and the utility corridor to be restored to prescribed VQOs several decades after mine closure with successful implementation of ASARCO's proposed mitigation. The ability to meet VQOs would depend on soil productivity and resulting tree growth. It is unlikely, however, that the top surface of the impoundment would ever meet Retention VQO standards because tree growth would be very slow or stunted under this alternative (see Forest Plan and Soils and Reclamation). Alternative II would significantly affect the project's ability to comply with Forest Service VQOs.

Alternative III

Exploration Adit

Mitigation measures that would shield or baffle exterior adit lights when visible at night from viewpoints in the Clark Fork Valley and treat the steel fuel storage tank and paint the building at the adit portal to reduce reflection would help reduce visual impacts to minor levels. Other mitigation measures to regrade waste rock dumps to approximate existing contours and revegetate with shrubs and trees as well as grasses would reduce impacts to low levels and help meet VQOs at the end of operations.

Tailings Impoundment

Long-term visual effects of the alternative tailings impoundment design would be similar to those for Alternative II -- introducing a large, new, and incongruous landform to the surrounding landscape. Visual impacts would result from the changed setting in the Clark Fork Valley and from Noxon and Cabinet Gorge reservoirs (see **figures 4-11, 4-12 and 4-13**). The alternative design would result in a delayed reclamation and revegetation schedule. Reclamation and revegetation could not be initiated on the lower portion of the impoundment face until completion of a 200-foot-wide sand shell after the seventh year of construction. Impoundment height would then be approximately 167 feet above surrounding terrain, more than 87 feet above any surrounding trees at the foot of the impoundment.

Final reclamation and revegetation would be completed in a phased sequence for the remaining years (8 through 33) where upstream impoundment construction methods were used. Following year 8 of operation, application of a colored tackifier or hydroseeding layer to the newly built impoundment lifts would help reduce the contrast and color prior to regrading, topsoiling, and planting. Planting containerized shrubs and trees along with seeding grasses and forbs in year 8 of operation rather than year 34 would help reduce the color contrast between the impoundment face and surrounding hillsides about 20 to 30 years after completion of construction. Constructing and regrading the impoundment faces to more closely resemble the surrounding landscape in form and shape would help reduce visual impacts in the long term. Respreading approximately 24 inches of soil on the impoundment would enhance tree and shrub growth and establishment (see Soils and Reclamation) and allow the surface to blend more effectively with surrounding hillsides several decades after mine closure. Long-term visual impacts to recreationists using surrounding trails, roads, and wilderness areas located above the impoundment would continue until tree cover became established. Views of the impoundment along Montana Highway 200 would be screened by 6- to 10-foot trees planted adjacent to the highway soon after permits were granted.

Other facilities associated with construction of this alternative impoundment design would be a minor source of visual impact -- the primary cyclone areas at the northeast corner of the impoundment, secondary cyclones located on the crest of the impoundment, and a 50-foot-wide and 4,000-foot-long road and pipeline right-of-way on the hillside directly above the impoundment. Other features would be present for decades after mine closure -- seepage collection berms, ditches and pumphouses surrounding the impoundment base, seepage return lines on the impoundment face, and a 4,600-foot-long diversion ditch above the impoundment. Use of noncontrasting colors and tones for life-of-mine facilities and immediate revegetation of disturbed soils around these facilities would make these a minor source of visual impact. Visual impacts from the tailings impoundment under Alternative III would be significant.

Mine, Mill, and Associated Facilities

Visual impacts of the West Fork mill site during mine operation under Alternative III would be similar to those for Alternative II. Agency-proposed mitigation to treat and/or paint mill facilities to blend with the surrounding landscape would reduce impact levels somewhat, but visual impacts would still be adverse in the short term due to the presence of an industrial facility in a previously natural landscape and its high visibility from surrounding roads (see **Figure 4-14**).

Overall visual impacts would decrease slightly under this alternative. Deposition of waste rock in two dumps on hillsides above the mill site and revegetation with trees and shrubs would help reduce the rock dumps' long-term visual impact. A new access road to the mine portals would not be built; however, 7,900 feet of the lower Chicago Peak Road would be upgraded from its present width of 14 feet to 24 feet for access to the adit, increasing cut-and-fill disturbances. Other maintenance roads and access trails to the surface conveyor transfer point, conveyor towers, and powerline structures would be the same as Alternative II. The 3,000 feet of buried 12-inch pipeline between the mine adits and valley floor would create a noticeable line on hillsides above the West Fork of Rock Creek until revegetation efforts were successful. Regrading and revegetating the mill site, and portal to more closely resemble the premining landscape would reduce long-term visual impacts to minor levels following mine closure. Long-term impacts would depend on the growth rate of trees and shrubs. Short-term visual impacts from the mill site and mine under Alternative III would be significant.

Utility and Transportation Corridors

The utility corridor with its above-ground pipelines, transmission line, and 12-inch buried water discharge pipeline would parallel FDR No. 150 for an additional 1.3 miles below Big Cedar Gulch and an additional 0.4 miles below the mill site under this alternative. These increased distances would result in increased visibility of the corridor. However, reducing right-of-way clearing would help create a more natural-appearing corridor. Vegetative screening for the substation in the lower Rock Creek drainage may have limited effectiveness in reducing its visual impact. Visual impacts would be similar to those for Alternative II.

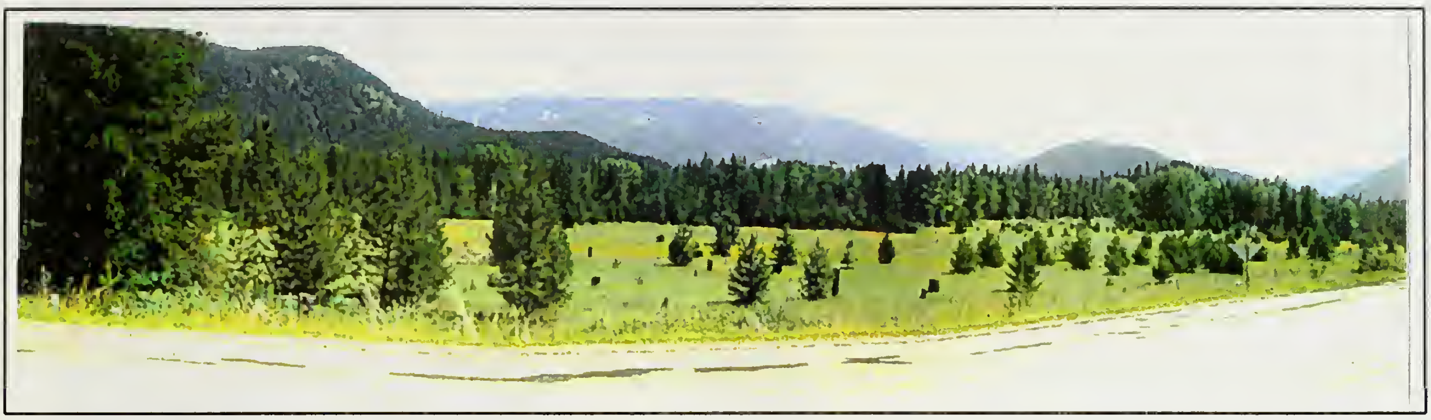
Other elements of this alternative such as construction of a new approach to Montana Highway 200 from FDR No. 150 and a new 0.2-mile type road between FDR nos. 150 and 1022 would not result in significant differences between alternatives.

Water Treatment Facility

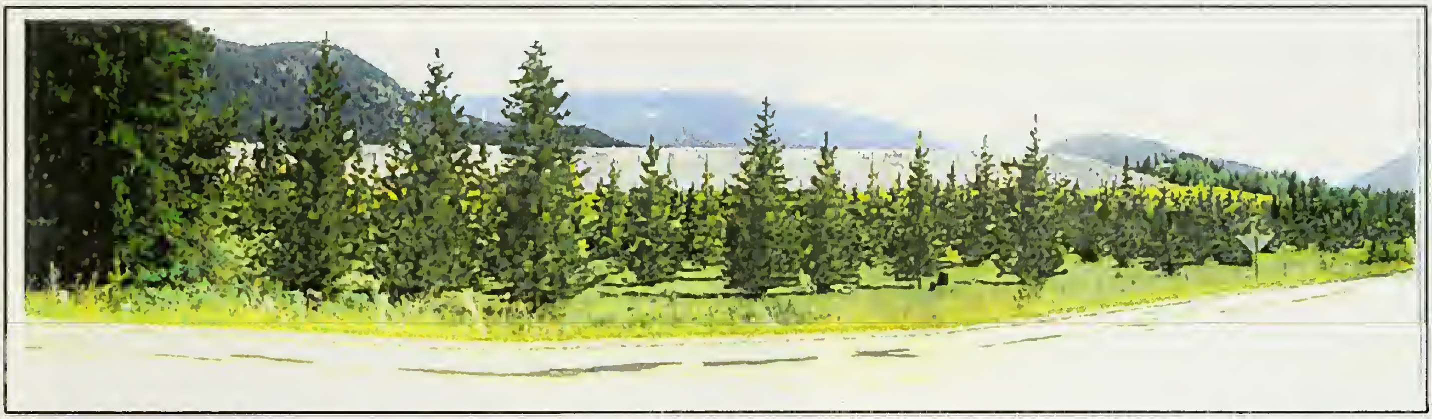
This facility would result in moderate visual effects to travelers and recreationists on FDR No. 150 during mine operation. While landscape alteration (cut and fill) would be less on this gently sloping site than that for Alternative II, the visibility of the facility would be high until sufficient vegetation could be grown in this logged area to effectively screen views for travelers.

Miller Gulch Rail Load-out

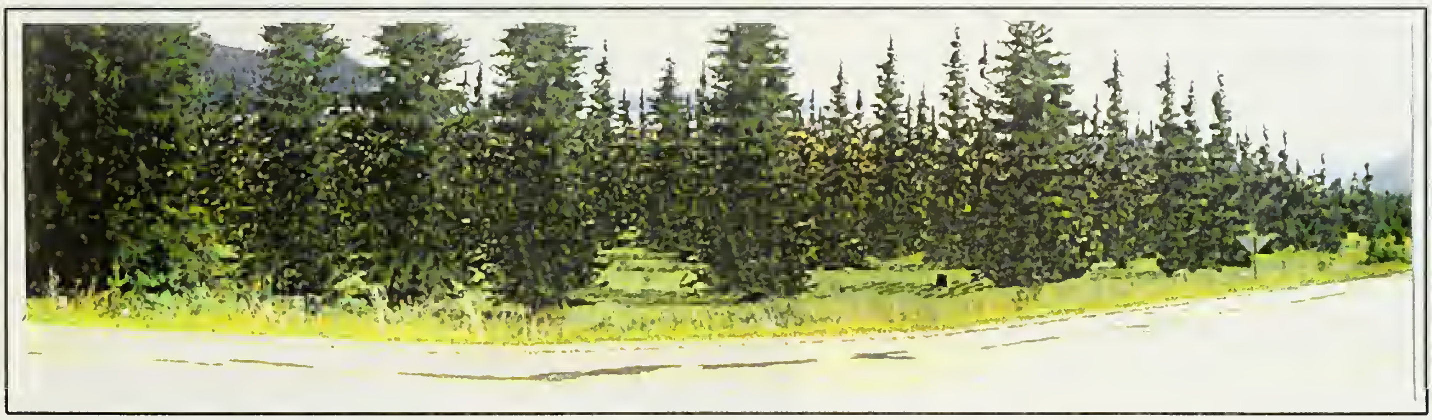
Travelers on FDR No. 150 going to and from Government Mountain would experience minor visual impacts from a rail siding location near Miller Gulch due to dust and increased traffic levels. Grading and tree removal would be necessary for additional track and construction of loading facilities, and a short 0.3-mile spur road off of FDR No. 150. The nearest residence to the rail siding would be about 0.2 mile away near Montana Highway 200 and screened from view by a 700-foot buffer of trees.



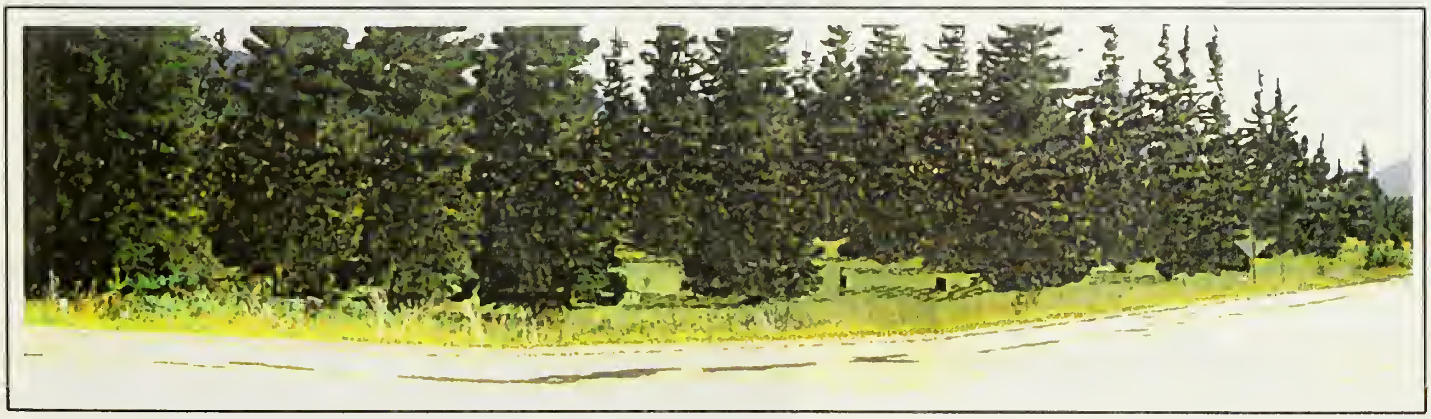
A. Existing View



B. Year 7 of Mine Operation

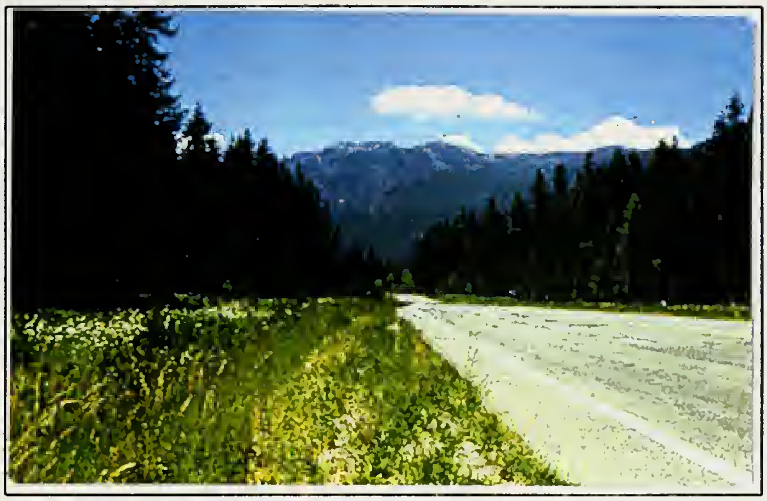


C. Year 33 of Mine Operation

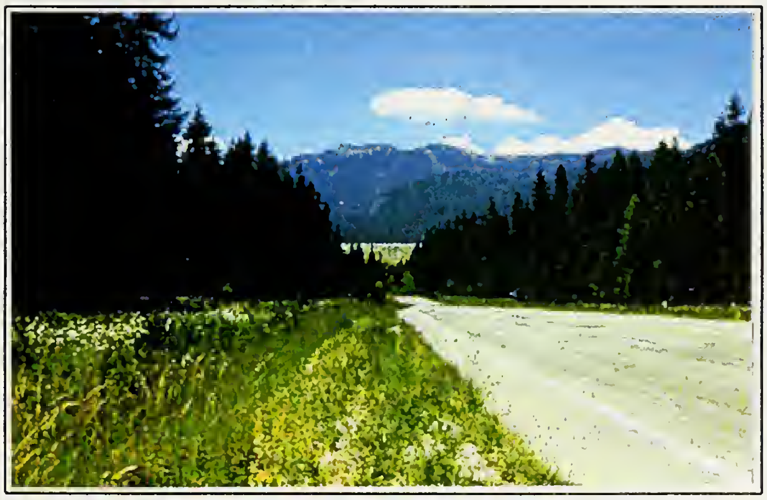


D. 37 Years After Mine Closure

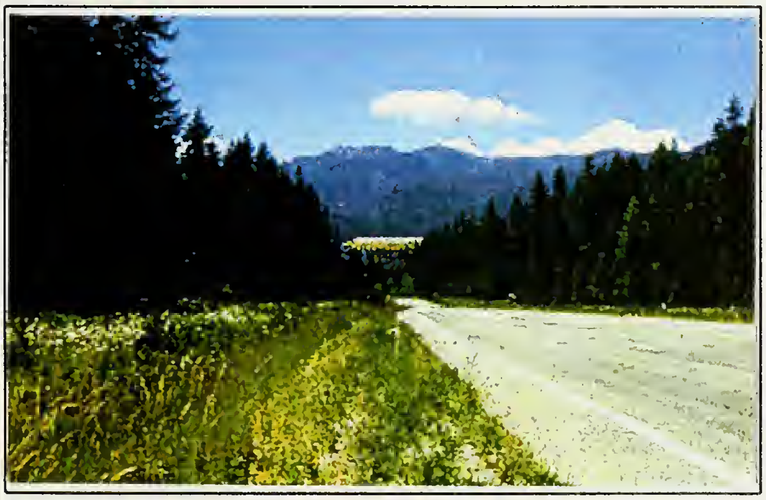
FIGURE 4-11
Visual Simulation of Proposed Tailings Impoundment (Alternative III and IV) - From Intersection of FDR No. 150 and Montana Highway 200 - (Viewpoint 1)



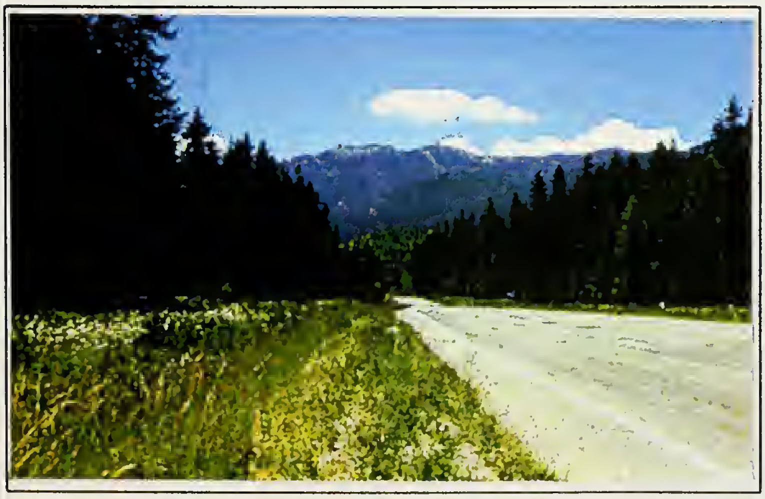
A. Existing View



B. Year 7 of Mine Operation

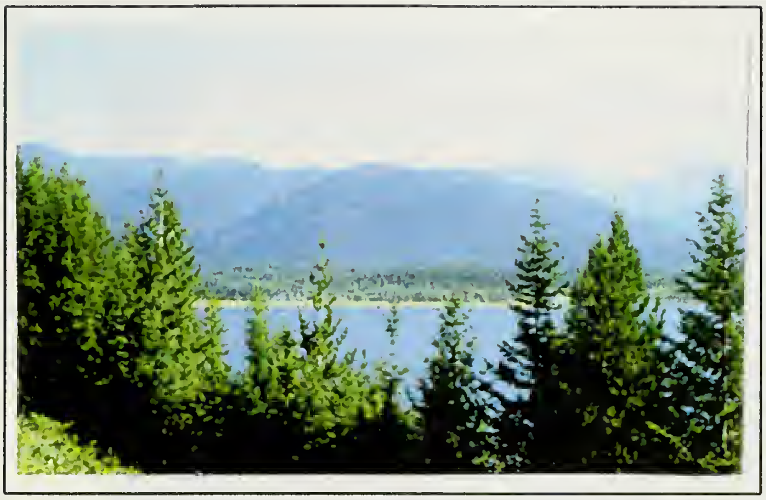


C. Year 33 of Mine Operation

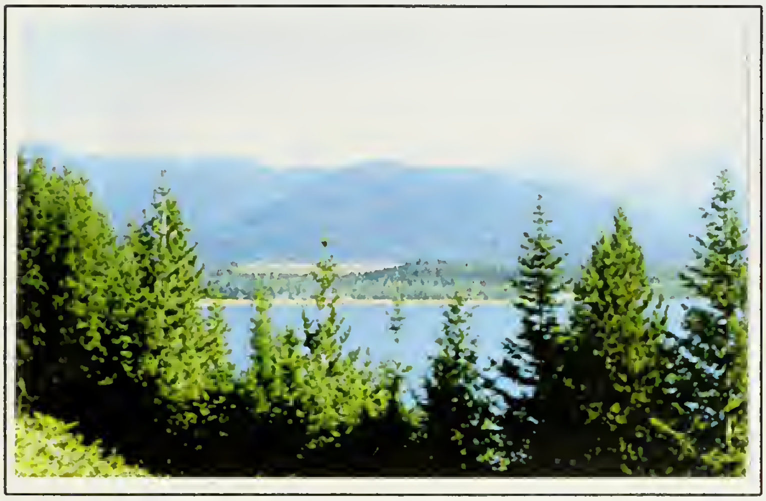


D. 37 Years After Mine Closure

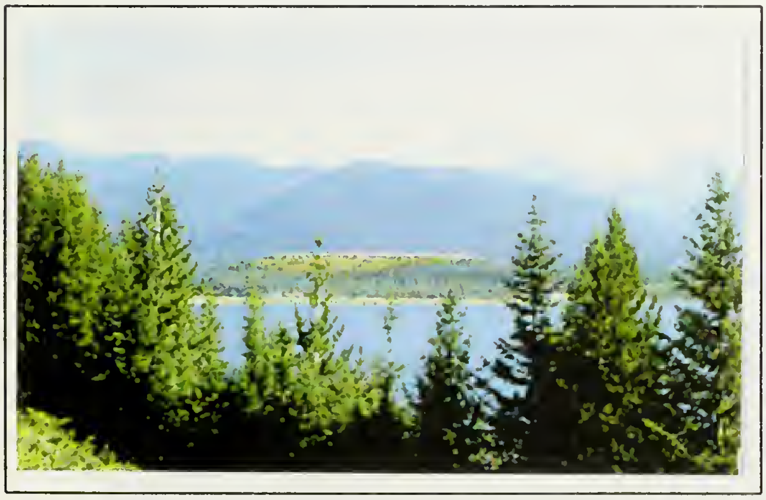
FIGURE 4-12
Visual Simulation of Proposed Tailings Impoundment (Alternatives III and IV) - From Turnoff to Noxon Dam on Montana Highway 200 (Viewpoint 3)



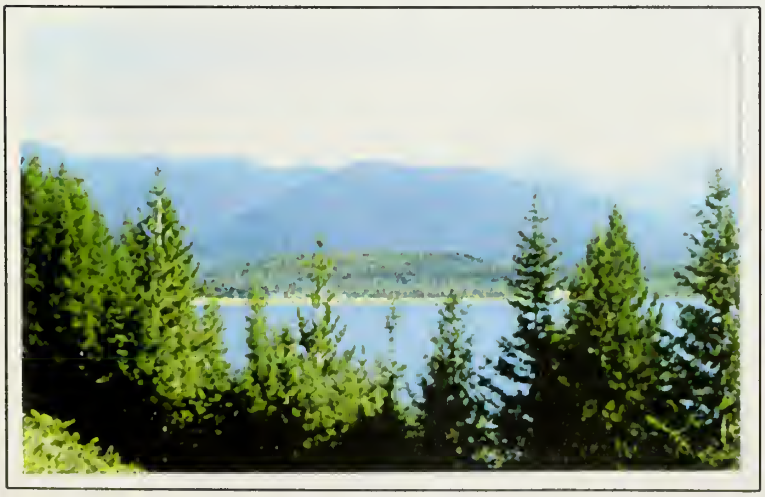
A. Existing View



B. Year 7 of Mine Operation

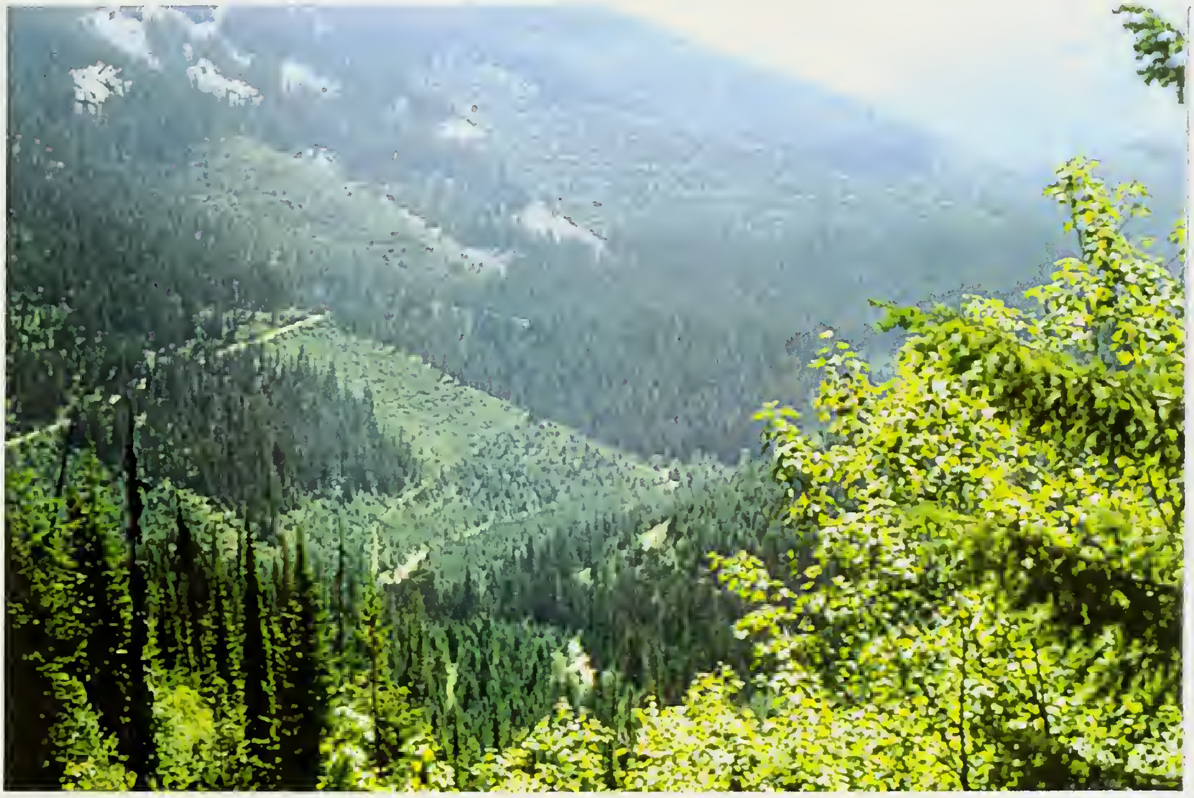


C. Year 33 of Mine Operation

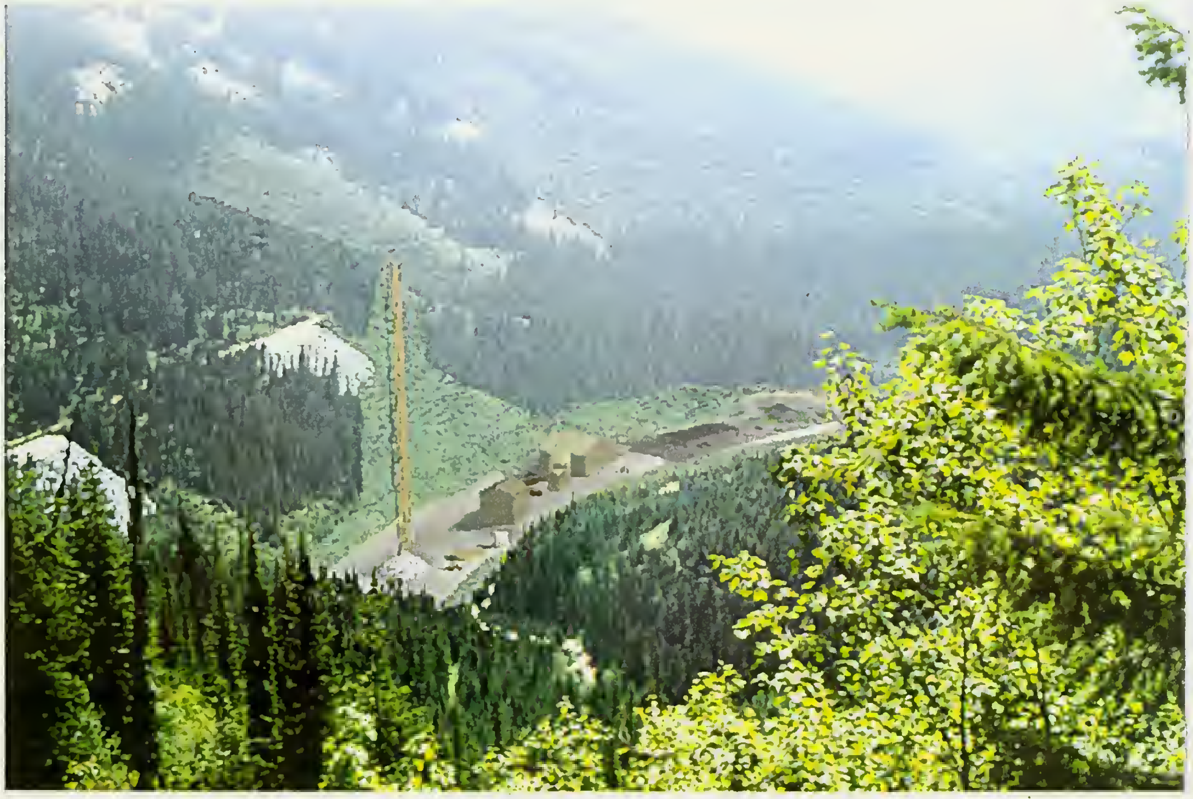


D. 37 Years After Mine Closure

FIGURE 4-13
Visual Simulation of Proposed Tailings Impoundment (Alternatives III and IV) - From FDR No. 2229 on South Side of Noxon Dam (Viewpoint 2)

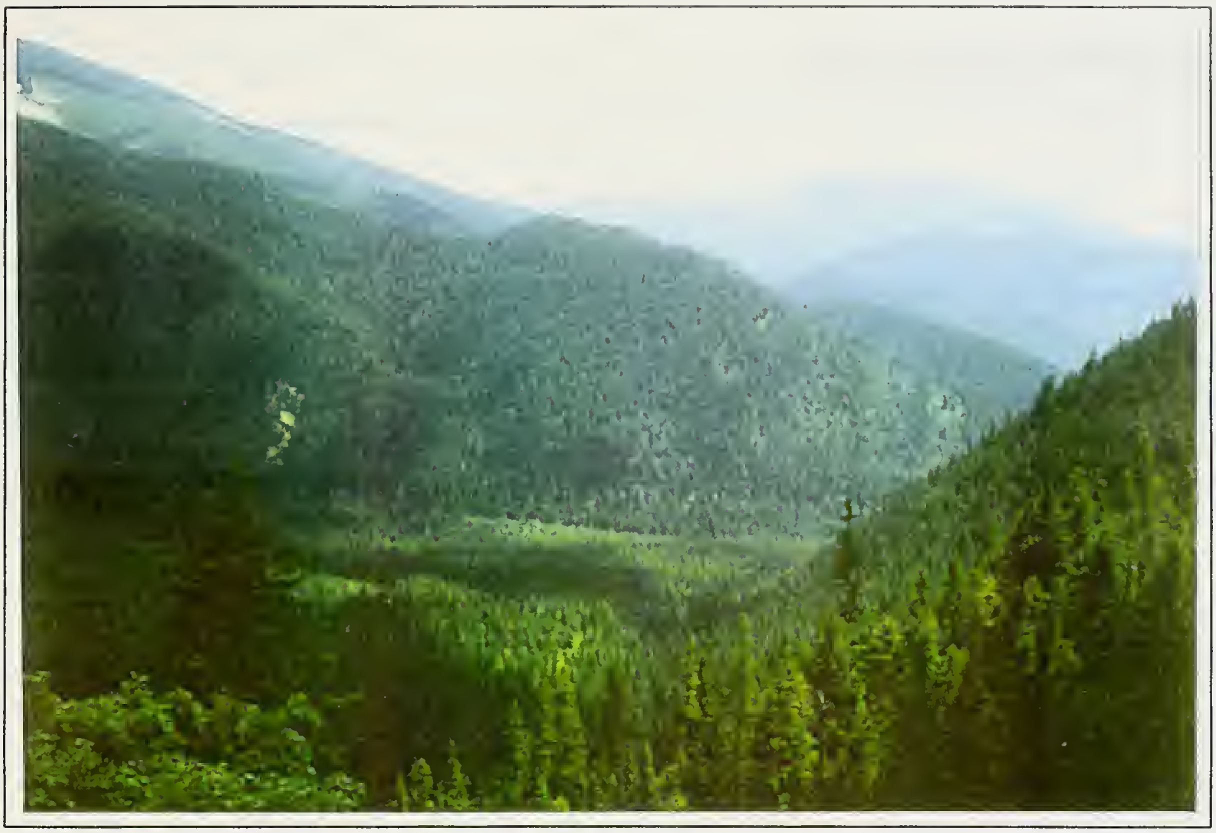


A. Existing View

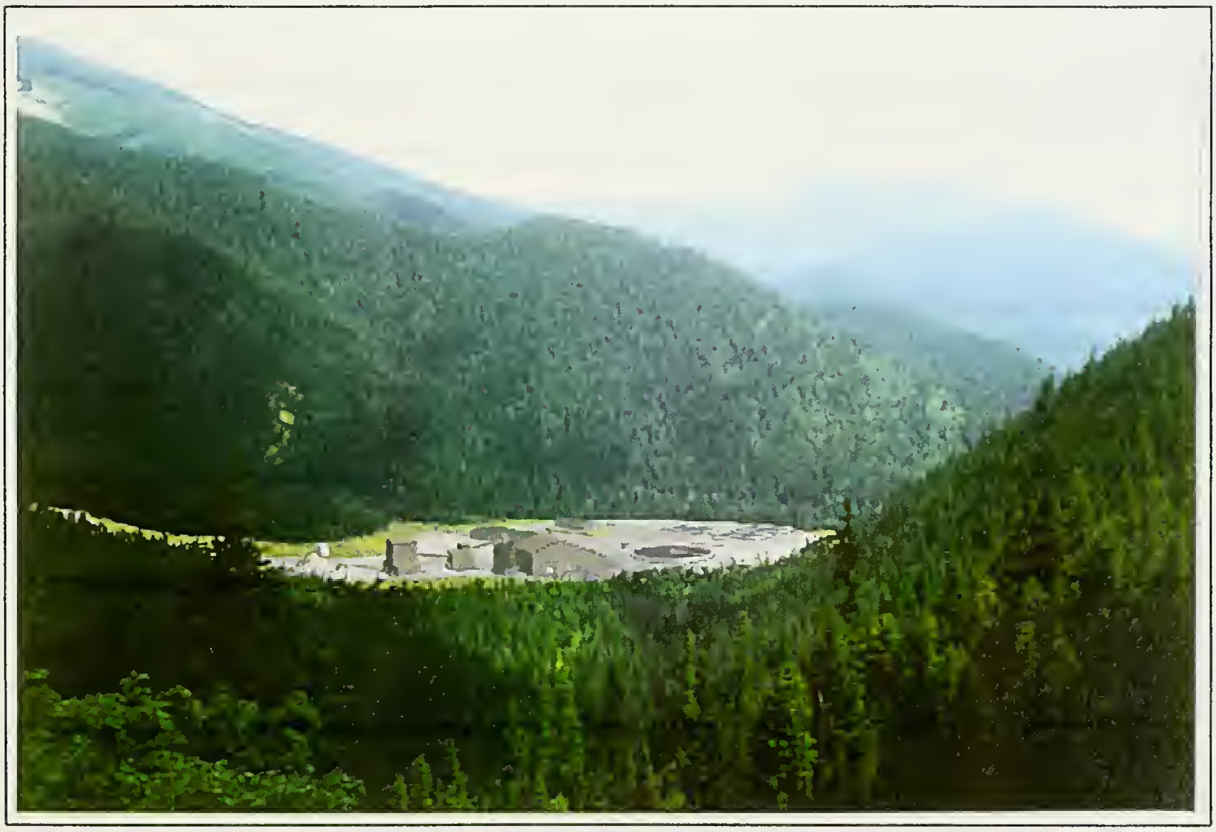


B. View During Mine Operation

FIGURE 4-14
Visual Simulation of Proposed Upper Mill Site - (Alternative III) From FDR No. 150 (Snort Creek Drainage) on East Side of Government Mountain (Viewpoint No. 4)



A. Existing View



B. View During Mine Operation

FIGURE 4-15
Visual Simulation of Proposed Confluence Mill Site - (Alternative IV) - From FDR No. 150 on East Side of Government Mountain (Viewpoint 5)

Effects on CMW Visitors

The visibility of the impoundment during operation from Goat, Engle, and Rock peaks in the CMW would be the same as Alternative II. Agency-proposed mitigation for reclamation of the impoundment surface would be more successful at establishing sufficient tree cover to blend the surface with surrounding terrain and reduce its visibility from wilderness viewpoints. The higher cliff location for the ventilation adit on the north face of Saint Paul Peak would result in a smaller area of surface disturbance though visibility of the adit could be increased depending on final location (see Wilderness). Surface treatment of the adit opening following mine closure to restore natural color and texture should make the opening virtually undetectable.

Compliance With Forest Service VQOs

Project facilities would not meet either prescribed or Forest Service VQOs during mine operation. Successful implementation of Agency-proposed mitigation and reclamation in Alternative III would help restore the visual quality of project facilities to prescribed VQO standards but it would still require several decades. Agency-proposed reclamation techniques (see Soils and Reclamation) would improve tree growth and increase the likelihood of the tailings impoundment surface eventually achieving prescribed VQO standards. Alternative III would significantly affect the project's ability to meet the Forest Service VQO time frames.

Alternative IV

Visual impacts of the tailings impoundment, exploration adit, utility corridor, water treatment facility, new road construction for FDR nos. 150 and 1022 in the lower Rock Creek and Clark Fork drainages, and the Miller Gulch rail load-out would be the same as those for Alternative III.

Mine, Mill, and Associated Facilities

The mill site at the confluence of the East and West forks of Rock Creek would use waste rock from the adit to create a large pad approximately 50 feet high covering 47 acres. Its terraced shape and flat top, as well as the portal area immediately upslope of the mill pad, would create forms that would contrast with the adjacent natural landscape during mine operation.

A 100-foot-minimum visual buffer of trees retained between FDR No. 150 and the mill site would limit foreground views and reduce impacts for recreationists using this road and FDR No. 150A. The mill site would be visible in middleground views from portions of FDR No. 150 near Snort Creek on the east face of Government Mountain and FDR No. 2741. For those viewpoints above the mill site, its elevated location at the confluence of two drainages, industrial character, and lack of vegetation would increase contrast with the surrounding landscape (see **Figure 4-15**). The large soil stockpile near the mill site also would create a contrasting shape and color during mine life. Final revegetation of pad faces immediately following construction (about year 4 of operation), regrading and shaping the pad surface during final reclamation to a more natural shape, and replication of naturally occurring species and their distribution during revegetation would help reduce visual impacts to low levels in the long term.

Associated facilities for the more compact confluence mill site would create less contrast than those for the West Fork mill site. The 750-foot long conveyor would drop about 100 feet from the conveyor adit to the mill site (compared to a 2,400-foot long conveyor at the West Fork mill site). A 1,200-foot mine access road would be located largely within the mill site. The utility corridor would be 5.5 miles long, the shortest of the action alternatives. The West Fork of Rock Creek would retain much of its existing natural character, except for road upgrades and other facilities needed for the exploration adit. Visual impacts from the mill site and mine under Alternative IV would be potentially significant in the short term.

Effects on CMW Visitors

Visitors to Ojibway Peak at the head of the East Fork of Rock Creek would have a distant view (approximately 5 miles) of the confluence mill site. Visitors to Rock Peak and those entering or leaving the CMW by way of the Engle Peak Trail (No. 923) also would have background views of the confluence mill site (3 miles distant).

Compliance with Forest Service Visual Quality Objectives

Even though the mill and mine facilities would not meet either prescribed or Forest Service VQOs during mine operation, their short and long-term visual impacts at the confluence mill site in this alternative would be mitigated by a vegetative buffer around the site and the lack of a waste rock dump. It is possible that the VQO of Partial Retention could be achieved for the confluence mill site after successful implementation of all mitigations and reclamation after several decades. Alternative IV would significantly affect the project's ability to meet the Forest Service VQO time frames.

Cumulative Effects

Timber sales on NFS and corporate lands and continued commercial and residential development in the Clark Fork Valley, in addition to project facilities, would alter existing views in the project area. The Montanore Project on the east face of the Cabinet Mountains would not result in direct cumulative visual impacts to the study area. No CMW viewpoints identified for this project would be within view of the Montanore Mine. However, indirect impacts may occur for CMW visitors, as either project may be visible from some view points (see Cumulative Impacts for Wilderness). The Checkerboard land exchange, road closures to meet KNF standards, and continued exploration for locatable minerals should have no major cumulative effects on the visual setting of the Clark Fork Valley or Rock Creek drainage. Cumulative visual impacts for all the action alternatives would be potentially significant depending on the viewer's vantage point and distance from project facilities as well as viewer expectations and values.

PART 2: PROBABLE ENVIRONMENTAL EFFECTS THAT COULD NOT BE AVOIDED

Forest Plan

Mine-related facilities would conflict with Forest Plan designated uses in the Rock Creek and Miller Gulch drainages. Mine facilities would convert MA 13 (old growth), MAs 10 and 11 (big game winter range), and MA 14 (grizzly bear habitat) to industrial uses for the mine life and possibly beyond. Therefore, if this project is approved, management area changes would be made to reflect appropriate designations for proposed uses.

Air Quality

Even after compliance with applicable state and federal ambient air quality and emission standards, there would be some minimal air quality degradation associated with the project. Monitoring of the operation as described in **Appendix H** would verify compliance on an ongoing basis.

Geology

The recoverable portion of the Rock Creek ore body would be permanently removed.

Soils

Soil erosion to some degree would occur under all alternatives, even with implementation of mitigation measures proposed. The degree of impacts varies among the action alternatives. Soil productivity would be reduced in some locations such as the tailings impoundment area where soil profile characteristics would be drastically changed over premine conditions or in areas that would be unreclaimed such as some sections of new road.

Hydrology

The underground mine would produce water that would require disposal. During the operational period of the mine, some excess water would be used at the proposed mill facility, and some excess water would be treated and discharged to the Clark Fork River. After mining was complete, and assuming the mine adits were not sealed, excess mine water would meet State discharge permit requirements and would be discharged to the Clark Fork River. If the adits were sealed after mining, the mine would fill with water until steady-state conditions were reached, where inflow would equal outflow. It is uncertain where outflow from the mine would discharge.

Development of the proposed tailings impoundment would permanently remove more than 300 acres of natural catchment area in the Miller Gulch drainage.

Sediment loading to Rock Creek and the Clark Fork River would increase over baseline conditions due to erosion from mine-related construction in these drainages.

Nitrogen loading below the proposed mill site would temporarily increase during project construction. The increase in concentration cannot be estimated with certainty. All nitrogen would be leached out within 1 to 5 years.

Loading of nutrients and dissolved metals in ground water below the proposed tailings impoundment would increase over baseline conditions. The increase would be limited to an Agency-approved ground water mixing zone and would likely exist over several decades.

Waters of the U.S. and Wetlands

There would be an unavoidable loss of wetlands under all action alternatives.

Aquatics/Fisheries

Declines in fish abundance in Rock Creek could be expected under any action alternative. These declines would be the result of the combined effects of habitat and water quality degradation, of the project and natural events and foreseeable activities. The degree of impact varies between action alternatives.

Biodiversity

Populations of crested shield-fern, a Forest Service sensitive plant species, would be destroyed as well. Populations of plant species of special concern that would be destroyed include pointed broom sedge, wintergreen, black snake-root, yerba buena, and fringecup. Impacts to these species vary by alternative.

Wildlife habitat would be physically lost, rendered ineffective, and fragmented. A significant reduction of old growth habitat would occur under alternatives II and III. A reduction in population and diversity of old growth- associated-species would occur. Long-term viability of old-growth-associated species in Rock Creek would be unlikely. An overall decline of biodiversity in the Rock Creek drainage would result.

Declines in abundance of breeding harlequin ducks would be expected under all action alternatives.

Some wildlife would be disturbed and expected to be displaced from the project influence area for variable amounts of time.

Some mountain goats would be expected to be displaced from the project influence area and may not return. Declines in the Rock Peak goat herd would be expected under any action alternative.

Wildlife mortality would increase due to increased risk of vehicle-wildlife collisions, poaching, and habitat alteration.

Threatened and Endangered Species

The project would displace grizzly bears from the project influence area in the short term.

Socioeconomics

Action alternatives would provide increased local employment opportunities, and would cause an immigration of workers and job seekers. This would cause local population fluctuations, boost economic activity and tax revenues, increase social and government service needs during periods of rapid population change and increase local housing costs.

Private lands along Rock Creek, and the Clark Fork and Bull river valleys could be converted to residential and recreational uses. NFS and private lands in the permit area would be devoted to mine uses during the life of the mine.

Transportation

The project would convert certain NFS lands to roads, and traffic and accidents would increase in the project area during mine life.

Recreation

Increased use of and access to the Rock Creek drainage would occur, and recreational use of mine facilities sites would be restricted during mine life.

Wilderness

The CMW would experience increased use, access would be restricted, and mine activities would likely be heard, seen, or smelled from some locations within the CMW.

Cultural Resources

Cultural resources would continue to be impacted by neglect and the indirect impacts associated with increased human activity and growth in the area. These impacts would occur under all alternatives.

Native American Treaty Rights

Potential effects on fisheries, wildlife, and vegetation as well as restrictions on access would limit tribal members from fulfilling their treaty rights during mine life. Some of these effects could last into the long term.

Sound

There would be elevated noise levels in the Rock Creek drainage generated by project construction and operations. Additional traffic would generate slight increases in traffic noises in western Sanders County. Use of the Hereford load-out under Alternative II would increase noise for nearby residents.

Scenic Resources

Visual impacts of all action alternatives would be direct, long term, and unavoidable. Existing settings and landscapes would be dramatically altered in the Clark Fork Valley and the Rock Creek drainages for all action alternatives.

PART 3: SUMMARY OF THE RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Forest Plan

The short-term mine construction and operations could devote as up to 380 acres of existing grizzly bear habitat, old growth habitat, and big game winter range to mine-related uses for life of the project. These changes in use would require amendments to Forest Plan management designations to those appropriate to proposed uses in the short term, and subsequent appropriate revisions to the plan after mine closure. MA 31 (Mineral Development) designations would likely remain in place for the foreseeable future.

Air Quality

During mine life; air pollutant concentrations would be higher than current levels. Once mining and reclamation were completed, the pollutant concentrations would return to premining levels, assuming adequate revegetation success.

Geology

The tailings impoundment would be a permanent facility. The construction of the impoundment and associated dams would irreversibly alter the topography in the impoundment area. Construction of the mill would irreversibly alter the mill site topography.

Soils

Soil losses would be a short-term. Soil productivity decreases would be short-term for much of the permit area. However, soil productivity would be decreased for the long-term (30+ years) in the tailings impoundment location because soil profile characteristics would be drastically changed over premine conditions.

Geotechnical Engineering

Risk of impoundment failure would decrease over time as the impoundment dewatered.

Hydrology

During mining, excess adit water would either be used in the mill or treated and discharged to the Clark Fork River. After mining, flow from the adit would continue to be discharged to the Rock Creek if the adits were not sealed, and the discharge met applicable water quality standards.

During mining, the perimeter collection system would create a barrier to ground water flow in Miller Gulch and recharge would be reduced by about 131 gpm. Recharge would return to premining levels after seepage water quality met applicable water quality standards.

Mill make-up water would be withdrawn from a ground water source near the confluence of Rock Creek and the Clark Fork River during mine operation. Once mining was completed, the need for make-up water would be eliminated.

Waters of the U.S. and Wetlands

Short-term impacts to Waters of the U.S. and wetlands would occur during construction activities due to increased sediment contributions. Proposed BMPs would reduce sedimentation. Other potential short-term impacts would result from time delays between the development and functioning of the created wetlands and the destruction of the existing wetland resources. A long-term impact would result from the 30-year delay in reconstructing the Waters of the U.S. channel at the proposed mill site.

Short- and long-term impacts may occur to wetlands downstream of the proposed tailings impoundment. The capture of surface water by the tailings impoundment and the capture of both surface and ground water by the proposed tailings impoundment seepage collection system would reduce the total drainage area contributing to the wetlands and potentially reduce the duration of saturation, inundation, and ponding of water in these wetlands. Decreased surface and ground water flow, especially during the growing season or dry periods, may allow vegetative species more tolerant of drier sites to replace species requiring more moist site conditions.

Aquatics/Fisheries

Impacts from the action alternatives would be short term. Most impacts to the aquatic environment, such as increased sediment or impacts from spills, should recover within 30 years. Even if local eliminations of aquatic species should occur, recolonization should generally be rapid once the habitat recovered, particularly for macroinvertebrate and algae species.

However, in the unlikely event of a tailings impoundment failure, impacts on the aquatic environment would be long term. Spills of heavy metals could have long-term impacts on the aquatic environment. If overall habitat degradation was extensive, loss of bull and/or westslope cutthroat trout could be long term or permanent.

Biodiversity

Most of the wildlife habitat would be rendered ineffective for the short-term. Long-term loss of habitat would occur on the tailings impoundment and portions of the mill site. Habitat would return upon successful reclamation of the land, however, it may not be the same type of habitat. Loss of old growth and decline in biodiversity would be a long-term effect. Long-term habitat loss would also occur for those species that require passage of information to offspring, such as the harlequin duck and mountain goat.

Wildlife mortality would increase. During mine life, vehicle-wildlife collisions would occur at much greater rates, resulting in the death of individuals. Poaching and hunting mortality would also increase. Increased wildlife mortality due to road-kill, poaching, and hunting could result in the long-term loss of some species such as goats, fishers, lynx, and wolverine.

In the short term, wildlife more tolerant of open areas (the impoundment area, road and utility corridors) would likely increase within the study area. In the long term, as these sites become reforested, other species would return.

The extent of impacts resulting from the loss of specific sensitive plant populations on the long-term viability of some of these species is unknown.

Threatened and Endangered Species

The short-term effect to bald eagles, peregrine falcon, and gray wolf would be displacement of individuals attempting to use available habitat in the project area. No long-term effects are anticipated for these species.

Short-term effects to grizzly bear include changes in habitat components; a reduction in timbered cover and increase in open grass or shrub fields. The reduction in habitat effectiveness for grizzly bear would be long term (35 years minimum), as would the loss of movement corridors for grizzly and wolves. When a female grizzly is displaced from an area traditionally used, and she has cubs, she is unable to teach her cubs how to use the area as she historically did. This means that there could be a delay in the re-establishment of grizzly use in the disturbed habitat for several bear generations (50 years or more) (U.S. Fish and Wildlife Service 1993a) after all activity stopped.

Socioeconomics

The increased local economic dependence on mining in the short term would retard the expected employment growth of more sustainable service industries in the long term.

Short-term mine construction and operations would devote an estimated 2,000 acres to mine uses for 33 years, including about 700 acres that would be used exclusively for mining. The long-term effect would be the loss of about 400 acres of private timber lands to less productive uses. In addition, between 2,000 and 3,000 acres (depending on the alternative chosen) of private land would be acquired by fee title or conservation easement for grizzly bear mitigation in the long term.

Transportation

In the short term, winter access would be increased in the Rock Creek drainage up to the mill site. Roads would not be snowplowed once mining ceased, returning access to premining conditions in the long term.

Cultural Resources

Cultural resources are nonrenewable. All short-term uses have the potential for permanent impacts to the long-term historic and interpretive value of cultural resources.

PART 4: IRREVERSIBLE & IRRETRIEVABLE COMMITMENTS OF RESOURCES

Forest Plan

The project would irretrievably devote NFS lands to mining uses for the 35-year life of the project. This would substantially reduce local grizzly, timber, and old growth land uses in the Rock Creek drainage. Following completion of mining, about 125 acres of NFS lands would not return to premining uses and would remain as MA 31.

Geology

Assuming 70 percent mine recovery, approximately 100 million tons of ore would be removed by the Rock Creek Project, with about 43 million tons left for structural support of the mine workings. Approximately 166 million ounces of silver and 1.37 billion pounds of copper would be removed from underground. Actual overall metal recovery would be slightly less because of mill and smelter losses. Approximately 71 million ounces of silver and 0.59 billion pounds of copper would remain underground in structural supports. Their future recovery is very unlikely. Construction and operation of the Rock Creek Project would result in the irreversible commitment of these resources.

Subsidence would be an irreversible effect of mining if it occurred.

Soils

Some soil would be irreversibly lost during construction and operation of the mine prior to the re-establishment of vegetation. Minor adverse effects would result from prolonged soil stockpiling, but following soil replacement, most soils should reach pre-mine productivity levels over time. Soil productivity in the impoundment area would be irreversibly reduced. Soil productivity for areas such as new roads that would not be fully reclaimed also would be irreversibly reduced. Soil productivity would be irretrievably lost for all other unreclaimed areas until the end of mine life.

Hydrology

Water currently stored in joints and fractures above adits and mine workings would be drained and used in the milling process or treated and discharged to the Clark Fork River. Following mining, water would continue to flow into the mine workings. Water levels in the mine would rise until surface discharge occurs along natural pathways or at the mine adits. Use of water stored in joints and fractures would be an irreversible commitment of resources.

Proposed discharges from the passive biotreatment cell would alter the water quality in the Clark Fork River. Tailings impoundment seepage would alter water quality in the ground water mixing zone primarily by increasing the concentrations of nitrogen and metals. Changes in surface water or ground water quality would be an irreversible commitment of these resources.

Ground water quality effects in the impoundment area would decrease following mining operations as impoundment seepage decreases. Some seepage from the impoundment would continue in perpetuity. The tailings are not anticipated to be acid generating, and the quality of the discharge would remain the same or improve with time. Any permanent change in ground water quality in the ground water mixing zone and tailings impoundment areas would be an irreversible commitment of resources.

The withdrawal of make-up water from the Clark Fork River alluvium or the Clark Fork River would be an irretrievable commitment of this resource.

Mining activities would intersect water-bearing joints and fractures during underground operations. The use of stored water would be an irreversible commitment of resources.

Assuming the adit portal could not or would not be permanently sealed, water from the mine would likely discharge to the Clark Fork River in perpetuity. The expected quality of the mine discharge water is discussed in Hydrology. Mine discharge water quality would likely improve with the cessation of underground blasting and mining activities, and likely approach ambient levels in several years. Because the concentrations would be expected to vary with time, the loss of higher quality water in the Clark Fork River would be both irreversible and irretrievable.

Development of the proposed tailings impoundment would modify more than 300 acres of natural catchment area and permanently remove one spring in the Miller Gulch drainage. Alteration of the natural drainage area and the spring would be an irretrievable and irreversible commitment of resources.

Seepage from the proposed tailings impoundment would degrade the quality of ground water in a mixing zone but would be removed as long as the pump-back system was in operation. Seepage would decrease following mining operations. Some seepage from the impoundment would continue in perpetuity. Because the loading rates would be expected to vary with time, a minor reduction in ground water quality in Miller Gulch would be both irreversible and irretrievable.

Overlying surface and ground water resources could potentially be affected if faults or fractures acted as ground water conduits and ASARCO's pilot hole testing and grouting programs were ineffective. As a result, water levels in lakes and surface outflow from the lakes might be reduced. The reduction in flow or in lake level cannot be quantified, and would likely be irreversible, if it occurred.

Waters of the U.S. and Wetlands

There would be an irreversible and irretrievable loss of wetlands and Waters of the U.S. under all action alternatives. Construction of ASARCO's proposed mill facilities, access road, and tailings impoundment would result in the irreversible loss through burial of natural habitat of about 8.1 acres of wetlands. The proposed wetland mitigation plan, if successful, would create about 12.3 acres of wetlands to compensate for the loss which would replace the functions and values of the destroyed wetlands.

An irretrievable loss of approximately 1.5 acres of Waters of the U.S. would result from the routing the existing drainage channel through ASARCO's proposed mill site facility. The proposed mitigation plan, would recreate the 1.1 acres of Waters of the U.S. at the end of the mining by re-establishing the drainage channel in approximately the same location as it was prior to constructing the mill site.

Aquatics/Fisheries

If the impacts of the proposed mine are sufficiently severe to cause the loss of bull trout or westslope cutthroat trout in the Rock Creek drainage, this would be an irretrievable loss of resources.

Biodiversity

An irretrievable loss of old growth habitat would result. Additionally, some general wildlife habitat (such as travel corridors along Rock Creek) would be irretrievably lost.

Some populations of plant species of special concern would be irreversibly lost. In large part due to lack of knowledge about genetic viability, ecosystem requirements, and species adaptability, current sensitive plant conservation techniques have not been proved to be successful alternatives to avoidance.

The effects of physical habitat loss, reduction of habitat effectiveness, habitat fragmentation, and/or increased mortality could result in an irretrievable loss of some wildlife individuals and/or local populations.

Potential loss of a subpopulation of harlequin ducks could be an irretrievable and possible irreversible loss, if such a loss occurred.

Threatened and Endangered Species

Due to the length of the proposed activity, the loss of available habitat and reduced habitat effectiveness, the habitat carrying capacity for grizzly bear would be reduced. The loss of additional habitat could further reduce the carrying capacity to the point that a viable level of grizzly bear could not be supported. This would be an irretrievable loss.

The disturbed areas would have less habitat effectiveness than currently exists even with proposed reclamation. This is based on a high probability of reduced productivity.

Socioeconomics

The action alternatives would irretrievably alter the social and economic life of western Sanders County for up to 30 years. Increased demands for housing, social services, and employment would be irretrievable commitment. Both increased employment and the associated loss of alternative service employment would be irretrievable. The ongoing economic diversification and social structure changes in western Sanders County would be delayed for at least the life of the project.

Land uses directly affected by mining would be irretrievable except for the tailings impoundment site; the land at the tailings impoundment would not be returned to its former productivity. Conversion of land to project-associated development, such as residential and commercial development along Montana Highway 200, would likely be irreversible.

Transportation

The gravel used in road construction and reconstruction would be difficult to salvage for other uses due to the relative shallow thickness (from a few inches up to 1 foot) over the road prism, and to the possibility of contamination with soils and other larger rocks. The asphalt used for the bituminous surface would be difficult to reuse, but bituminous surfaces have been recycled for use in road reconstruction. Commitment of gravel would be irreversible and use of asphalt would likely be.

Recreation

Some of the mine employees could be expected to stay in the area after the life of the mine. Those people could continue to engage in recreational activities in the area. Recreational resource demands would probably be slightly higher after mine closure than future demand without the project. However, it is not expected that mine employee recreational resource needs would significantly deprive other recreationists in the area from enjoying those same resources. Project-related recreation demands would irretrievably commit a portion of the recreation resource in western Sanders County.

Wilderness

Site disturbance associated with the ventilation adit would exist after mine life. Reclaimed disturbance from the adit would consist of a pile of rocks. This rock pile might look unnatural as compared to other rock piles in the vicinity. An irreversible impact to apparent naturalness would occur under Alternative II.

Cultural Resources

Any impacts to cultural resources are irreversible due to the nonrenewable nature of the resources.

Native American Treaty Rights

Impacts to treaty rights would be irretrievable unless the bull trout or grizzly bear was lost due to project impacts. In this case, there would be irreversible loss of those treaty rights.

Sound

The quiet sound levels characteristic of rural and wilderness environments would be irretrievably lost.

Scenic Resources

The project would be visible from viewpoints in the Clark Fork Valley, NFS lands, and the CMW. The visual impact of the utility corridor, waste rock dump, exploration adit, and ventilation adit would significantly affect some viewers. The proposed reclamation and revegetation plan, when completed, would serve to decrease the visual effects of mine components. However, the Rock Creek tailings impoundment, waste rock dump for the exploration adit, mine waste rock dumps for alternatives II and III, and both mill sites would irreversibly alter the natural landscape. Development of these project components would be an irreversible commitment of these visual resources.

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